RAILROAD GAZETTE

FRIDAY, SEPTEMBER 28.

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Contributions.

Why Locomotive Boilers Explode.

CAMBRIDGE, Mass., Sept. 18, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your remarks in the *Railroad Gazette* of the 7th inst., with reference to boiler explosions, are very apropos at the present time.

It is hardly an exaggeration to say that there are very few safe boilers on locomotives in this country, and if I were asked to name the poorest designed structure of a dangerous nature that I have seen, I should, without fear of successful contradiction, name the American locomotive boiler.

No stay-bolt boiler is safe without the Belpaire fire-box and butt jointed longitudinal seams. I purposely mention the stay-bolt boiler, for I consider the Strong boiler, which has no stay-bolts, to be safer than the Belpaire, and practically inexplosive, for low water cannot do more than cause a collapse, generally without rupture, of the fire-boxes.

My reasons for making such wholesale assertions with respect to the stay bolt boiler are as follows:

No person can by any possible means compute the stresses in a crown bar stayed or a direct stayed system of supporting the crown sheet, and therefore nobody knows whether his boiler is safe or not. If the crown bars are not "slung up" to the shell, the stresses in them can be computed, but then the steam pressure on the crown sheet is tending to push the inside fire-box out of the boiler, and thus place the stay-bolts in transverse stress (which must be a cause of stay-bolt failure), and finally tending to rotate the base-ring. This latter should in this case, if in no other, be double riveted.

If the crown bars are slung up the top of the outer shell is depressed and the sides bulge out, a deformation which is somewhat prevented by transverse tie rods above the crown sheet. Nevertheless, nobody can say to what stress the parts are subjected. Moreover, nobody can say whether the deformation of the shell strains the plates beyond the elastic limit or not. Nobody can say that furrowing is not produced by this action, and it is difficult to know when furrowing takes place.

A direct stayed boiler is in a similar state.

In striking contrast with this state of affairs is that in the Belpaire fire-box. Here all stresses can be easily computed, and the parts properly proportioned. The steam pressure on a given area of the outer crown sheet is exactly balanced by that on an equal area on the inner crown sheet. The upper structure is therefore in equilibrium, there is no transverse stress in the stay-bolts, no tendency to blow the fire-box out, and no need of double riveting the base-ring. The vertical sides of the fire-box above the crown sheet are stayed by transverse rods, which can be exactly proportioned to their duty.

The Belpaire fire-box, which, by the way, can be a wagon top, possesses the additional advantages of giving large steam space, large steam liberating surface to the water and free circulation, and doubtless is a better steamer than the usual form.

Many of the boilers (especially of the high pressure boilers) of to-day have their longitudinal joints formed by a lap and an inside bent covering plate. This is one of the worst examples of unmechanical construction to be commonly found in engineering practice. It has been my good fortune to test this form of joint experimentally on a large scale in the Watertown testing machine, and it behaved very badly. After the lapped part of the joint was utterly ruined, the bent welt proceeded to straighten out and finally sheared off its rivets, reminding one of locking the stable door after the horse is stolen. It will always behave in this way, and is, therefore, a death trap. The strength percentage of this joint is very low, in spite of the fact that some tests of such joints have shown, when made under exceptional conditions, a high percentage. Nobody would think of making a bent tension member if he could avoid it anywhere else than in a boiler.

I never could understand the popular aversion to butt joints, and I trust that the Pennsylvania Railroad is to be followed by all other roads in their use. F. W. DEAN.

Special Orders and Collisions.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your journal of Aug. 24, page 560, you say that conductors and enginemen depend each upon the other "for the performance of important duties, the neglect of which is often fatal and the performance of which is especially enjoined upon both men with equal force." You undoubtedly had in mind the rule, a clause of which reads: "Conductors and enginemen must examine the registers and know that all trains of the same or superior class due have arrived before starting from terminal stations, leaving junctions or passing from double to single track;" and that clause of another rule which says, "Operators, when special orders are sent, shall deliver one copy to the conductor and one to the engineman, which they will read while the operator reads the order aloud to them." In case a train had been tied up for a considerable time at a siding, the conductor and engineman might walk together to the operator and receive their orders, but it certainly would be a very noticeable variation from usual practice. The practice is for the engineman to oil around and look his engine over while the conductor gets the orders, signing for both; as he hands one copy to the engineman he usually tells him the purport of the order. A very few conductors read the order aloud while the engineman verifies his copy.

A freight train is running ahead of a through passenger train, No. 1, and is at the limit of the time it has the right to main track ahead of No. 1. If it has to side track and No. 1 should be late, the freight would be compelled to take siding again at a station further on in order to avoid some other passenger train, and in consequence be several hours longer making the run. To avoid this delay the conductor has gone over the train to the engine and said to the engineman as they approach the place where they should side track, "Don't stop nor pull in at this end of the siding, just roll along slowly by the station and I will try to get orders to run in advance of No. 1; if we can't get them we will back in." He jumps off, runs into the office, asks for and receives time over No. 1, and rushes out just in time to jump on rear of caboose, as he gives the signal to proceed. That is all right; it is common every day practice, and just such work as is requisite to get freight over the road. But where he makes an error is in sending the engineman his copy by a brakeman; it is passed from one brakeman to another until it reaches the engineman in a very much rumpled, frequently wet, and occasionally almost undecipherable condition. He reads Long Branch for East Long Branch, or mistakes a figure 3 for a 5, and disaster follows. Had the conductor gone to the engineman and said: we run to East Long Branch, or we have one hour and thirty minutes over No. 1, even though the latter had accepted the statement without reading his copy all would have gone well. The habit of sending orders is particularly dangerous, for the reason that neither then knows the other's understanding of the order. Some conductors permit the front brakeman to sign for orders. The careful conductor does no such thing, and when he receives a special order, instead of acting as though he was the possessor of some secret of state, to divulge which would be instant death, he not only makes it his business to give the engineman his copy, but also to inform his brakemen, as the engineman should the fireman, what the order is. With this precaution taken, it would be almost an impossibility for an engineman to exceed his orders, even though his memory proved defective, because the train crew, knowing where they had to side track, would stall him.

But these men have not disobeyed the rules by getting their orders in this way; on the opposite page note the following: "Special orders must not contain any erasures, alterations or interlineations, except that in the printed line, 'conductor and engineman;' a line will be run under the word necessary to show the address of the party to whom the copy is given." It is carelessness in not conferring after the orders are received that causes the mischief.

It is not at the door between theory and practice that disaster enters; it is where positive orders are disregarded, either through negligence or ignorance. A man must be ignorant who willfully disregards a special order; if he fully realized the danger he would not dare risk disobedience. Quite recently a work train conductor on single track received an order: "After extra engine O, north, passes C, work extra between C and F, etc." He learned over the wire that extra engine O had not then left A, 8 miles distant. He pulled out of the siding and ran to D, 1¼ miles distant, and took siding. A curve intervened between C and D. The conductor gained possibly five minutes at the risk of meeting an extra which the dispatcher might have been running to be met and passed by extra engine O at C. It is just such criminal recklessness, such astonishing ignorance of the risk and danger, that makes it possible to chronicle so many collisions each month. Conductors and enginemen on extra trains are anxious to get over the road as soon as possible; by so doing they receive some credit for good work, and have more time to themselves at the end of the trip; but in their desire to make a good run, they should not lose sight of the fact that no excuse will justify a collision, and that absolute safety should be the first consideration of every train movement.

LANGDON.

New England Railroad Club.

The opening meeting of the season was in the form of a banquet at the Quincy House, Boston, Sept. 19. The after-dinner speeches were numerous and good, but consisted chiefly in congratulatory references to the prosperity of the club and the good prospects of a profitable Winter campaign. President J. N. Lauder occupied the chair, and the speakers were ex-Governor Smyth, of New Hampshire; F. D. Adams and J. W. Marden, ex Presidents of the club; J. W. Ellis, Chief Engineer of the Providence & Worcester; J. W. Coleman, and others. Two newspaper men quoted scripture, to the apparent satisfaction of the audience. Mr. Marden referred to the long interval between the annual banquets and suggested that a dinner, which is one of the best mellowing influences for this or any other club, should be held quarterly. Mr. W. W. Snow gave brief reminiscences of a trip in Europe, some of them humorous. His experience was that the roads on the continent take excellent care of their passengers. The guard, who has charge of three or four cars, knows where every passenger is bound and anticipates his every wish. At the stations two or three porters are ready for every passenger. Whether the fees expected or demanded in connection with this service are of the magnificent proportions customary among sleeping car porters in this country, Mr. Snow did not state. The upholstering of the passenger cars on the continent was especially commended. The reason why travelers there carry so many more bundles than is the fashion here is because every piece of baggage that is checked has to be paid for. Being ignorant of the language, Mr. Snow had to change cars suddenly without notice while his party was out at lunch, and he had 35 bundles to carry out, besides wearing three hats on his head.

Mr. Ellis referred to the necessity of more intimate relations between his profession and that of the men in charge of the motive power and equipment departments. The heavy coal cars with their tremendous loads now coming into all parts of New England prove a serious tax on the tracks of many lines, and the problem, of which the responsibility rests jointly upon the respective departments mentioned, is a serious one.

The next meeting of the club is on Oct. 10, and the subject for discussion is Quick Journeys and Fast Running, to be opened by a paper by Mr. George Richards, late of the Boston & Providence.

The Master Car Painters' Convention.

The nineteenth annual convention of the Master Car and Locomotive Painters' Association was held at the Hollenden Hotel, in Cleveland, O., on Wednesday, Sept. 12, President Samuel Brown, of the Old Colony, in the chair.

The President opened the session with a humorous address of welcome to the members (including the ladies who accompanied the members and who were invited to listen to the President's address) congratulating them on the large representation present from the different railroad shops of the country. The following 44 active members were present:

E. J. Aubrey (Chicago & West. Mich.); J. W. Bland (Missouri Pacific); Samuel Brown (Old Colony), A. J. Bishop (C., C., C. & I.); Warner Bailey (Concord); A. N. Bradley (Ohio & Miss.); A. E. Barker (Chicago & N. W.); H. M. Billings (Pitts., Cin. & St. Louis); A. S. Coleman (Intercolonial); Alex. Campbell (Manhattan Elevated); Thos. E. Coins (Chicago West Division St.); Edw. A. Cole (N. Y., Chicago & St. L.); E. L. Fetting (N. Y. & N. E.); Gallus Frey (Lake Shore & Michigan Southern); J. G. Ginther (Wabash, St. Louis & Pacific); J. A. P. Glass (Louisville, New Orleans & Texas); W. T. Hogan (Atchison, Topeka & Santa Fe); J. W. Houser (Cumberland Valley); A. J. Horton (Lake Shore & Mich. So.); F. W. Horn (New York, Penn. & Ohio); J. G. Keil (Chicago, Alton & St. Louis); Eugene Laing (Nor. Cent.); A. P. Le Gros (Louis., Cin. & Lex.); Wm. Lewis (Grand Trunk); Geo. W. Lord (Fitchburg); W. T. Ledford (Richmond & Danville); Jas. Looker (Wabash, St. L. & Pac.); R. W. McMasters (Wabash, St. L. & Pac.); B. F. Murphy (Richmond, & Allegheny); John McMurtry (Pittsburgh Loco. Wks.); Robt. McKeon (New York, Penn. & Ohio); Jos. Murphy (Louis. & Nash.); W. J. Orr (Buffalo, Rochester & Pittsburgh); Wm. O. Quest (Pittsburgh & Lake Erie); John Rattenbury (Chicago, Rock Island & Pac.); W. J. Russell (Grand Rapids & Indiana); J. C. Stout (Union Pac.); M. W. Stines (Barney & Smith); M. L. Sims (E. Tenn., Va. & Ga.); A. C. Sensenbach (late St. Charles Car Works); D. W. Smith (Cleveland & Pittsburgh); W. H. Wise (North Carolina); J. A. Workman (Cleveland & Canton), Canton, Ohio; J. D. Wright (Chicago, Rock Island & Pac.).

Secretary and Treasurer McKeon made his annual report, which showed a gain of 18 members since last report, making the present membership 118.

The receipts for the past year were $218; expenditures, $188.21, leaving a balance in the treasury of $281.13.

The following officers were elected for the ensuing year: President, Samuel Brown, Old Colony; First Vice-President, W. T. Hogan, Atchison, Topeka & Santa Fe; Second Vice-President, William Lewis, Grand Trunk; Secretary and Treasurer, Robt. McKeon, New York, Pennsylvania & Ohio, Kent, O.

The discussion of subjects followed:

1. *The best filler for the inside finish of passenger cars and how it should be made and applied.* Papers were read by E. A. Cole (New York, Chicago & St. Louis) and Wm. Lewis (Grand Trunk). A general discussion followed, but it was generally conceded that corn starch was the best and was used by nine-tenths of the car shops. The formula for making was somewhat different in the proportions of liquids, but rubbing varnish, japan, gold size and turpentine with the starch made a good and reliable filler for hard wood. In the application some rubbed it with rags, while others claimed good results by scraping with a broad knife.

2. *Is it practicable to oil and varnish passenger cars on the outside on the natural wood, such as mahogany, redwood, cherry, etc., and not paint them?* R. W. Scott (Chicago, St. Paul & Kansas City) presented a report favoring this style of finish and claiming satisfactory results from this method of finishing. E. E. Hartshorn (Maine Central) took an opposite view of the question in his report and considered that it was not practicable. A general discussion brought out very little favorable to adopting a natural wood finish on the outside of cars. Coaches that had been finished in this way when first put in service never could be revarnished, but had to be painted, the wood turning dark at joints and on window-sills where water had penetrated. The putty also shows badly on the battens, as the wood grows darker by age, but the putty does not change. To illustrate the impractibility of finishing in this way, the sash and doors of a car were brought into the discussion, they being frequently left the natural wood finish, but always had to be

painted and grained when the car came in the shop for re-varnishing, this being done in imitation of the wood.

3. F. S. Ball (Pennsylvania) read an able paper on "*The Apprenticeship System in the Car Paint Shop.*"

4. *What is the best paint for tin roofs to prevent rust and protect them from cinders?* Every member present gave their experience. A few believed that coating the underside of the tin and painting the car roof before laying the tin was a preventive of rust, but on most roads this was not practicable as the sheets were laid singly; but the majority favored simply painting the tin roof after laying with three coats of Rinnes' metallic paint mixed with boiled oil and japan, but applied thin and finish with as strong a gloss as possible, so that the cinders would slip off, and the turn or bull nose at the end of the car should have several extra coats to protect it from the constant beating of the cinders.

5. *What constitutes the purest and most durable body of paint ready for the finishing color that we can get on passenger and baggage cars in the shortest time?* J. T. Cockburn (Cinn., Ind., St. Louis & Chicago); M. L. Sims (East Tenn., Va. & Ga), and A. Latsch (Illinois Central), gave methods and formulas for preparing a passenger car ready for finishing color in from 12 to 15 days, after which a lengthy discussion was entered into as to the best material for the foundation. White lead seemed to have the majority, providing good lead can be had.

6. *Is it advisable to wet nail holes before puttying, on what coat is it best to putty, and how should putty be made for coach work?* Reports were read from E. E. Earl (Northern Pacific) and E. J. Aubrey (Chicago & West Michigan). The first question was answered in the affirmative, but it was not practicable, and only one or two members followed that plan. The second question was answered by puttying on the second coat. This was generally followed by all the members, as they desired the nail holes and all joints should be thoroughly filled with paint before puttying, which would prevent swelling. Several formulas were given for making putty, all of which had given good results, but white lead, Japan, rubbing varnish and a good mineral were the principal ingredients. One member claimed to have good results from puttying with plaster of Paris, and while lead and oil putty swelled, the plaster of Paris remained solid.

7. *The best system of cleaning passenger cars preparatory to touching up and re-varnishing.* James Looker (Wabash, St. Louis & Pacific) read a very able report which commended itself to the meeting, giving formulas for cleaning, method of application and a clear idea of the entire work. The process was illustrated by taking three different shops. *a* The cleaning was done in a careful manner; *b* was not particular as to how it was done, and *c* was trying to see how cheap he could do the work, and while he saved expense, his cars never looked well, *b* was a little cheaper, but the work had to be repainted sooner than *a*, and *c* still sooner. It is economy to paint the car well in the beginning and take particular care in cleaning, and to re-varnish, which should be done at least once in 10 months, when the car will not require re painting for six years.

Some interesting queries pertaining to the everyday practical work of the painter were taken into consideration, and valuable information secured by the exchange of methods followed by different members.

The discussions then closed and the President appointed the several committees.

The Committee on Subjects for the Next Convention were granted 30 days further time to prepare a list for discussion.

The subject of adopting a badge or some emblem for members, to be worn as a pin or charm, was put into the hands of a committee of five, who will receive designs for the same, and report at the next Convention.

The Convention was more than usually interesting, and the members took an active part in all questions brought before them.

The Convention adjourned at 4 o'clock Friday afternoon, to meet in Chicago the second Wednesday of September, 1889.

Canal Lifts versus Locks.

There has been considerable activity in Europe in the last 10 years in new arrangements for transferring canal boats from one level to another. A brief review of these appliances is given below:

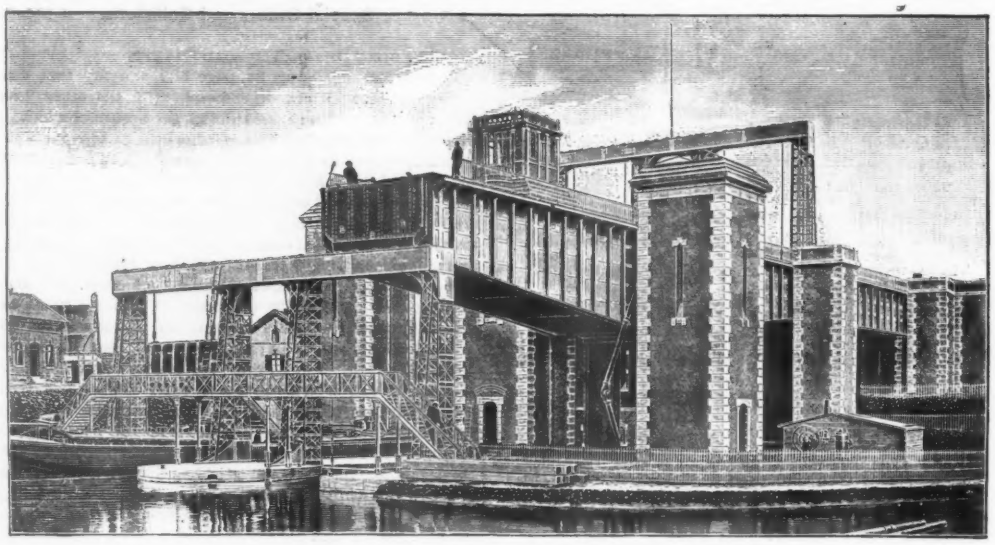
The canal lock is well known in its general features. It consists simply of a masonry basin, with two pairs of gates which close the lock chamber at each end. As both pairs are required to resist pressure from the higher level of the canal only, they both open in that direction, and one pair necessarily opens into the lock. When closed they are formed in plan like a very flat V to resist the water pressure which is thus transferred to the side walls of the lock. The gates are guided also into this position by the mitre sill, a masonry or wood sill in the lock bottom of the above V or mitre shape, against which they abut when closed. Each gate is provided with valves or smaller sliding gates operated by screws.

This was the system in its more primitive form. As locks become larger and the body of water to be operated on more bulky, it was found desirable to put openings into the lock walls, which by gates, in longitudinal channels in these walls, could be put in communication with the higher or lower level and supplement the valves in the gates in raising or lowering the lock level. Hydraulic machinery has also been put in, to operate the gates and valves of large locks like those on the Mississippi at Keokuk and at Sault St. Marie, between lakes Michigan and Superior.

Where the difference of level to be overcome at one place was considerable, as at Lockport on the Erie Canal, a chain of locks had to be resorted to.

The objection to locks in general is their expense, the delay to the traffic—each lockage taking not less than 15 minutes and generally much more—and the consumption of water, for which expensive feeders have frequently to be built for a canal. Where a small difference of level is to be overcome no more satisfactory method has been devised than the lock, but where a considerable rise or fall can be made at one place requiring several locks—for it has not been found practicable to rise much over 15 ft. with a single lock, and ordinarily not much over 10 ft.—it has been found advantageous to resort to some other form of lift.

The earliest scheme of this sort was put into effect on the Morris Canal, in this country. This was an inclined railroad rising out of the canal at the lower end, passing over a dam at the end of the upper level and descending into the latter.



HYDRAULIC CANAL LIFT AT FONTINETTES, FRANCE.

The railroad is double, and has an endless wire rope passing round a large sheave at each end and attached to cradles on either track. The boats are run upon these cradles, preferably one on each, at the upper and lower levels, respectively. The cable is then set in motion by turbine or other power communicated to the end sheave or pulley, and the boat is transferred with considerable dispatch and by a much less expensive appliance than a chain of locks from one level to the other. These inclined railroads may still be seen in operation at Newark, Bloomfield and other points on the Morris Canal, in New Jersey.

A new departure in this direction was made in 1875 on the Weaver Navigation, in England, by the erection of an hydraulic lift at Anderton from the designs of Mr. Leader Williams, at present engineer of the Manchester Ship Canal. This was followed in 1880 by the erection of a similar construction at Les Fontinettes, near St. Omer, in France, by the English firm of Clark, Standfield & Clark, who are also putting up a similar construction at La Louvière, on the Charleroi and Brussels Canal.

The principle of these lifts, of which the cut in this number represents that at Les Fontinettes, reproduced from *Industries*, is simply the raising or lowering of the boat in an iron caisson filled with water. The caisson is carried on the piston of a hydraulic ram. The caissons being in pairs, and of course weighing precisely alike, and the two rams being connected by pipes, when the two caissons are on the same level they balance each other. When one caisson is at the bottom and the other at the top, the lower one is immersed in water, and consequently much lighter. To maintain this position a valve in the pipe between the two rams is closed, preventing movement of water from one ram to the other. In this position the ends of each caisson adjoining the canal are open and the opposite ends closed by gates suspended from gallows frames on the caisson ends. When the transfer of boats is to be made the open end gates of the caissons are closed, and a similar gate at the end of the upper level of the canal is also closed. The space between these two gates, which is made as small as possible, is emptied by a special valve, allowing the water pressure in the caisson and in the canal to bring their respective gates to their bearings.

The communication valve between the two caisson plungers is now opened, and the upper caisson descends by virtue of the buoyancy of the lower one, which is partially immersed in water. This movement would cease as soon as the lower one left the water below but for an ingenious automatic siphon attached to it. This siphon (there are several to each caisson) has a short leg descending 6 in. below the normal water surface of the caisson. The longer leg, which is made considerably larger than the short one, descends on the outside of the caisson nearly to a level with its bottom. The result of this arrangement is that the long leg fills with water as a caisson descends into the lower level of the canal, driving out the air in the up bend of the siphon. As soon, then, as the caisson begins to rise out of the water the siphon goes into action, drawing water from the caisson until it is reduced to the level of the siphon mouth, when air of course enters the siphon and stops its action. This of course allows the light caisson to continue up until the descending caisson has become sufficiently submerged in the lower level to again balance the rising one. At this point the communication valve is shut, the water is allowed to escape from under the plunger of the falling caisson, so that it is free to descend to the lower level. At the same time water is let into the hydraulic cylinder of the rising caisson from an accumulator until the caisson is raised with its bottom level with that of the upper level of the canal. In order to make good its connection with the latter it is first necessary to make a tight joint with it. This is done automatically by a beveled wooden face, which moves upwards against a corresponding face on the fixed canal and compresses a rubber washer in so doing. This was the method used at Anderton, but it appears to have been replaced at Fontinettes by a rubber bag or tube fastened to the end of the caisson and distended by compressed air to a close junction between the two faces of the joint.

At Fontinettes the caissons descend into a dry pit, the end of the lower canal level being closed by a gate precisely as is the upper one. This enables the movement to be made without any manipulation of valves during the movement, but involves extra handling of gates which are of course counterbalanced, and also the pumping out from the lower pit of leakage water.

It dispenses also with the siphons, but substitutes valves which have to be operated by hand. The great advantage claimed for this method, however, is the reduction of the size of accumulator and the amount of power needed to operate with.

It is obvious that this is considerable, since under the Anderton method the upper caisson must be lifted bodily 4½ ft. At Fontinettes an accumulator is used, but only for slight adjustments of the positions of the troughs and not for any considerable lift.

The time required for the transfer of a boat of the largest size from the moment when it begins to enter the caisson until it is entirely out is 42 minutes at Fontinettes, while the descent of the flight of 5 locks which the lift replaced took 2 hours. The height lifted is 43 ft. The caissons are guided by metal flanges bolted to the masonry at the centre pier and at the upper end.

The saving of water in these appliances is very great. In cases where the traffic is largely downwards, so that the upwards boats carry a large amount of water with them in the caisson it may happen that the movement of water will be up and not down, the weight of the loaded boats serving as a sort of pump power. This is expected to be the case at La Louvière.

The difficulties found in the execution have prolonged to a long period the time of execution of the Fontinettes lift, which was begun in 1880 and only put in operation last spring.

La Louvière, the latest, is by far the most important apparatus of this sort which has been as yet attempted, as will be seen from the following comparative figures:

	Caisson.				Maximum weight of vessel.	Amount of water used per lift.	Time of lift alone.	Cost of works.
	Length.	Breadth.	Depth of water.	Lift.				
	Ft.	Ft.	Ft.	Ft.	Tons.	Cu. ft.	Min	
Anderton	76.7	15.0	4.9	50.1	100	524	8	$240,000
Les Fontinettes	132.5	17.0	6.6	43.0	300	706	6 to 8	$380,000
La Louvière (4 lifts)	142.6	18.3	8.5	55.5 to 50.5	400	971	?	.. ..

Messrs. Clark and Standfield, the builders of the Fontinettes and Louvière lifts, are very busy with designs for similar ones on a new canal from London to Birmingham. A project is also on foot in France for the construction of a canal to connect the Garonne and the Loire.

A variety of other methods of transfer from one level to another has been proposed. Among these are the use of caissons, carrying the boats in water and traveling on wheel trucks on a railroad.

Greve, in Germany, has proposed to use inclined canal reaches with movable dams running on rails, each boat being drawn up or let down in a little pond of its own; but the practical difficulties in the construction and operation of such a system appear very great.

In order to extend the use of the lifts to German canals where larger boats are in use, designs have been made for caissons resting on two pistons each. As it is absolutely necessary to secure uniform movement of the pistons supporting the same caisson, Mr. C. Hoppe, of Berlin, has designed an ingenious valve which automatically maintains the pistons of the same caisson at the same height in rising or falling, and holds all four pistons perfectly in control of the operator, who has only to give a small water motor greater or less speed in order to make the caissons rise or fall at will.

Another design for the same purpose is to carry the cais-

sons on cylindrical floats submerged in tanks constructed under the lifts. The movement is effected by giving one or the other caisson an excess of water, and it is regulated by four small hydraulic pistons, which are made to work in precise unison by Mr. Hoppe's contrivance.

As yet, however, no lifts have been built or started on the German canal system, which depends upon locks for change of level.

The Waterhouse Automatic Regulator for Electric Lighting.

Mr. Addison G. Waterhouse, of the Waterhouse Electric & Manufacturing Co., of Hartford, Ct., has recently patented an automatic regulator in connection with the Waterhouse system of electric lighting. A regulator in a system of electric lighting is of the greatest importance, and it is claimed that this method of regulation is especially perfect.

In fig. 1 is represented a diagram of the Waterhouse type of dynamo with a closed circuit armature A. On the commutator C are three brushes; a and b are the main circuit brushes and c the auxiliary brush. From the positive brush a the current passes on the conductor around the field magnets F to the resistance R. The current from the auxiliary brush c passes directly to resistance R, leaving the field magnets out of circuit. The currents from both circuits (field and local) join at R and pass to the lamps, the current on the lamp line being the sum of the two. The amount of current in the field and local circuits is in proportion to the resistance R in each. The brushes have a fixed position.

There is in every dynamo a point of maximum commutation on the armature which changes with the resistance on the lamp line, moving with the rotation (towards brush c) when the resistance decreases and back when it increases. This affects the current in the local and field circuits as follows: When lights are turned out the line resistance is decreased, and the maximum point moves forward and forces more current out of brush c and less out of brush a. This reduces the current in the field magnets and E. M. F. (pressure) of the circuit and consequently the power required to operate the dynamo. But the current on the lamp line remains constant because the local circuit is increased proportionately to the decrease of the field circuit. The remaining lamps, therefore, retain their full brilliancy, while the current cannot increase and destroy the apparatus. Thus the very tendency of the machine is to regulate itself without the aid of special mechanism. The addition of a regulator makes the regulation instantaneous by assisting the current to pass out at brush c, and opposing its passing around the field magnets by brush a, when lights are cut out. The current is forced out at brush a around the field magnets by opposing its passing out at brush c, when lights are cut in.

The regulator, as illustrated, is controlled by a slide in the form of a solenoid. Any tendency of the current to increase raises the contact (see slide, fig. 1), and the result is a decrease of resistance in the local circuit and an increase of resistance in the field circuit. More current will therefore flow through the local circuit and less through the field circuit. The generating capacity of the dynamo is instantly reduced and any tendency to produce a current above the standard is overcome. Should the tendency of the current be to decrease, say by a reduction of the speed of the armature, the slide lowers, increasing the resistance in the local, and reducing it in the field circuit. More current will then flow around the field magnets and less out on the local circuit. The generating capacity of the dynamo will therefore increase to maintain the current at standard. It should be stated that the use of resistance for balancing the field and local circuits is a small amount compared to that used by the lamps and is not interposed, as can be seen, for the purpose of compensating for lamps turned off.

The Waterhouse regulator varies the E. M. F. directly with the resistance on the lamp line, producing self-regulation, and maintaining on the lamp line the standard current whether one lamp or the full number are burning. By this method, as the lamps are cut out, the current is reduced in the dynamo even to the fraction of an ampère, and it is apparent that one light on the Waterhouse dynamos can be maintained for any length of time without producing more than the standard current.

Fig. 2 represents the Waterhouse dynamo, which has a closed circuit armature, that being the most efficient type yet produced. The armature has a large core composed of large disks insulated from each other, which overcomes the liability to eddy or heating currents. The armature shaft has long bearings, convenient oil-drips, a pan for collecting any oil that would otherwise saturate the floor, and from a mechanical point of view the dynamo is well made.

In fig. 3 is represented the arc lamp, which is a new invention even to its magnetic principle. The lamp magnet is quadrangular in shape, having two poles of variable polarity that control an armature beneath it on which is a lifting device which lifts the carbons and controls the arc. The control is purely magnetic and free from any mechanical friction, and a fine steady feed is maintained free from commotion producing unsteady light or hissing. It is stated that at the Centennial Exposition of the Ohio Valley, a large plant of 240 lights of the Waterhouse system burn so steadily that not a sound or hiss can be heard within the buildings, while the exhibits requiring the finest light are well illuminated.

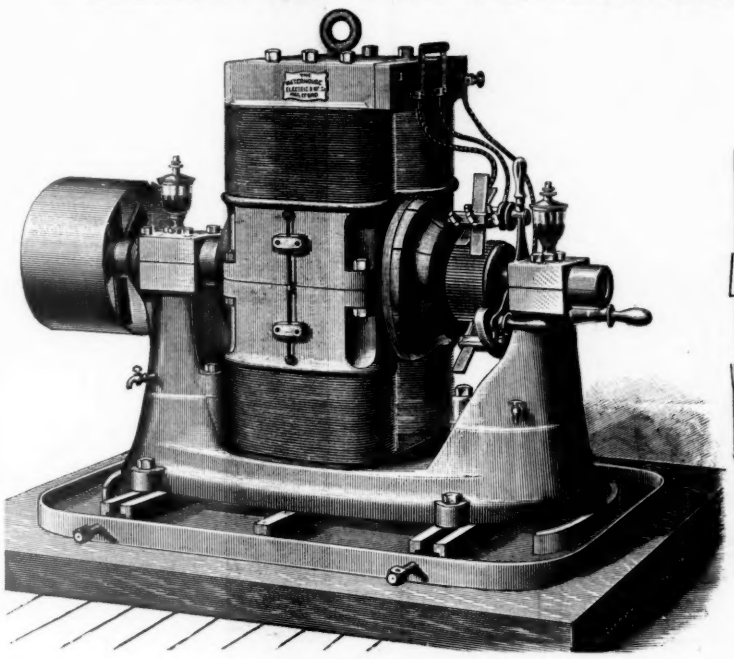


Fig. 2.

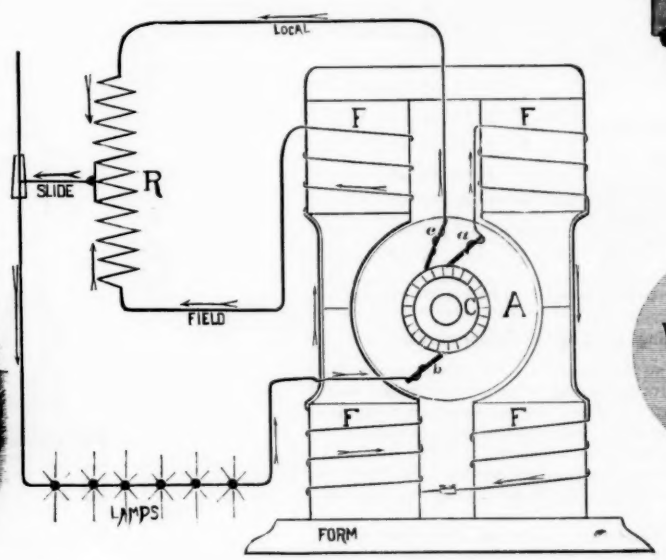


Fig. 1.

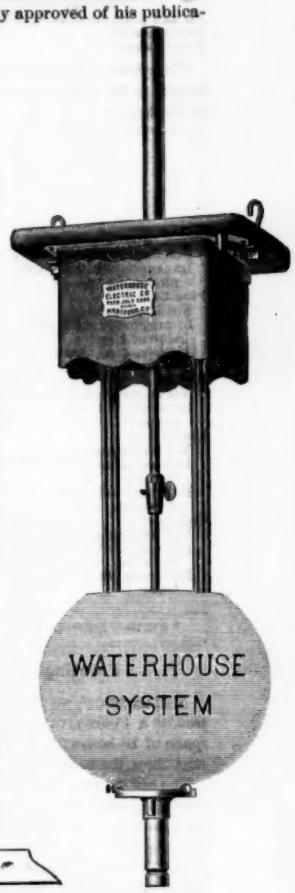


Fig. 3.

THE WATERHOUSE AUTOMATIC REGULATOR.

Made by the WATERHOUSE ELECTRIC & MANUFACTURING COMPANY, *of Hartford, Conn.*

North American Superintendents' Association.

The meeting of this association at St. Louis last week was, like previous gatherings of this body, almost wholly informal. The report of the Committee on Roadway brought out considerable discussion, and Major Gadsden, of the Charleston & Savannah, President of the association, gave some interesting data concerning wooden trestles. Captain Fleming, of the Savannah, Florida & Western, gave particulars about the system of track inspection used on his road. Major E. T. D. Myers, of the Richmond, Fredericksburg & Potomac, who is now traveling in Europe, sent a letter giving his impressions of railroad practice over there. Continuous heating, automatic air train signals and cattle guards were informally discussed and referred to committees. Eight new members were elected.

National Association of General Passenger and Ticket Agents.

At the meeting of this association in Saratoga, N. Y., on Sept. 18, the first business was the selection of the place for the next meeting, which was decided in favor of the Hotel Brunswick, New York City, March 19, 1889. The report of the Committe on Coupon Tickets was read and adopted. Further discussion of the question of regulation of the transportation of advertising matter was indefinitely postponed. The question of claims against foreign lines on account of erroneous proportions, which had been referred to a committee, was, by recommendation of the committee, referred to the association of accounting officers, with the recommendation that the limit placed upon settlements shall not be longer than one year. The question of half-fare round trip tickets from all points to Cincinnati, on account of the centennial exhibition there, was taken up and a resolution in favor of such rates was presented, but after some discussion the whole matter was referred to the several district organizations. Mr. W. F. Bailey, of Chicago, the compiler of Bailey's Compendium of Tariffs, Rates and Divisions, presented to the association his claims for support. The association had formally approved of his publication at a previous meeting, but after two years' issue there is a considerable deficit, and the association is asked to recognize the Compendium as its official organ, the members pledging themselves to furnish the compiler copies of all tariffs, etc. The association adopted a resolution reiterating its commendation of the publication and "suggested" that tariffs be furnished regularly to it. The Secretary was instructed to issue a circular of inquiry to members of the association to ascertain whether they will support the work. A communication was received from the Chattanooga & Lookout Mountain road, asking for an issue of through tickets over its line. The road can take Pullman cars from the Chattanooga Union station to the top of Lookout Mountain in 45 minutes. The question was referred to the district associations. The President, Vice-President and Secretary were appointed a committee to revise the constitution and by-laws. The reporting of foreign excess baggage collections was discussed, and the Secretary instructed to issue a circular asking the lines if they will comply with the resolution adopted at St. Paul by the General Baggage Agents' Association, Sept. 20, 1887. The Secretary is also to gather statistics as to the present practice, and tabulate them for the members of the association.

The members, on their return from the meeting, were the guests of the Fitchburg road, and passed resolutions of praise for the road and thanks to General Passenger Agent Watson.

Railroad Superstructure at the Vienna Exhibition.

The Journal of German Railway Directories in its account of the exhibits at the Railroad Exhibition of this year gives the following statistics of the present practice as to superstructure in Austria:

The standard rails in use on the main lines of that country, which are almost all of the T section, have the following dimensions:

Height	4.73 to 5.04 in.
Width of head	2.24 to 2.44 in.
Thickness of web	0.47 to 0.66 in.
Breadth of base	3.30 to 4.30 in.
Length	21.3 to 29.5 ft.
Weight per yard	66 to 83.5 lbs.

Rails 32.8 ft. long are beginning to be laid. The proportion of different materials for rails in Austria is as follows, in the existing system:

	Per cent.
Iron rails still good	29
Steel headed rails	3
Steel in tracks	35
Steel topped and iron rails about to be replaced by steel	33

The suspended joint is accepted throughout as the standard, and angle splices are becoming so.

Specimen bridge steel, tested at the exhibition gave, elastic limit, 31,021 lbs.; tensile strength, 50,953 lbs.; reduction of section, 70.5 per cent.; elongation, 28.2 per cent.

Rail steel showed as follows under test:

Elastic limit, lbs. per sq. in.	42,006
Tensile strength, lbs. per sq. in.	74,315
Reduction of section	53.03 per cent.
Elongation	26.00 "

The chief material for ties in Austria is still wood, oak being the favorite. Of other timber:

Fir and pine, furnished..... 25 per cent.
Larch, about..... 16 "
Beech, about..... 8½ "

Tie preservation is general. The following table gives the results in the percentages taken out during the term of years at the head:

	2 years.	4 years.	6 years.	8 years.	10 years.	12 years.	14 years	16 years.	18 years.
Beech ties:									
Not impregnated	15	100	....	....	....	....	....	....	....
Impregnated with sulphate of copper	2	5	18	33	48	59	70	*	*
Pine ties:									
Not impregnated	3	35	91	....	....	....	....	....	....
Impregnated with chloride of zinc	2	5	20	38	55	73	90	*	*
Impregnated with tar creosote	.	1	4	9	18	38	65	84	*
Fir ties:									
Not impregnated	1.5	10	29	55	81	....	....	....	....
Impregnated with tar creosote	....	....	1	4	9	17	26	35	*
Larch ties:									
Not impregnated	....	1	7	28	58	81	†	†	†
Impregnated with zinc chloride	....	0.5	3	9	25	43	63	†	†
Impregnated with tar creosote	....	....	1	5	14	30	51	†	†
Oak ties:									
Not impregnated	..	0.5	4	14	34	56	80	†	†
Impregnated with zinc chloride	..	....	0.5	4	16	31	41	46	†
Impregnated with tar creosote	...	....	0.5	1	7	20	33	41	†

* Further information wanting. † Later dates wanting.

Erecting an English Locomotive.

A short since* we illustrated the various stages of the erection of a Pennsylvania passenger locomotive in the short space of 16 hours 50 minutes. The accompanying engravings show the process of erecting an English locomotive.

The engine in question is a standard London & Northwestern goods or freight engine, and was built at Crewe in February last, some months before the Pennsylvania engine was erected.

Fig. 1 shows the first stage at 6 a. m., Feb. 4, the frame plates being laid on trestles and no fittings whatever being attached. The erection then commenced, and at 1 p. m., after 6¼ hours' work, the cylinders, as shown in fig. 2. were in position between the frames, the hornblocks, or axle-box rubbing pieces, outside angle irons, cross stretchers, cast iron foot-plate, etc., were riveted or bolted in their respective positions.

Fig. 3 is a view taken at 1 p. m., Feb. 5, and shows the boiler lagged and in position, the lower part of the cab fixed, and a part of the motion erected. The actual time worked up to this point was 16 hours.

Fig. 4 shows the engine as completed at 1 p. m., Feb. 6, the total time occupied being 25 hours 30 minutes. On the same day the engine ran a trial trip and was put in the paint shop for a final coat of paint.

It is difficult, owing to the different modes of erection adopted, to make any comparison as regards the relative time occupied in erection at Altoona and Crewe. At the latter shop the erection commenced with the bare frames, which, after over 6 hours' work, do not appear to have been so far advanced as the Altoona frames at the commencement of the erection. Making allowance for this, there appears to have been little difference in the time of erection, for while the total time taken was greater in the Crewe engine, only 9½ hours was occupied in finishing the engine from the time the boiler was between the frames, against nearly 12 hours for the Altoona engine. This, however, is a somewhat uncertain measure of the time, for in each case the photographs from which our engravings were made were taken during meal hours, and it is possible that one may have taken a few minutes and the other a few hours after the boiler was in position.

The engine is inside connected and the cylinders are inclined so that the piston rod and slide bars can clear the front driving axle. Horizontal outside cylinders would materially increase the weight on the front axle, as the cylinders would have to be placed fully 20 in. further forward in order to clear the wheel. Inside cylinders, which need only clear the axle, are therefore preferred for plain six-coupled engines, the usual type for freight engines in England.

The engine shown is one of the regular London & Northwestern freight engines, which are remarkable as being the most numerous class of locomotives in existence, over 700 of these engines being interchangeable. The two cylinders are cast together, and as one valve chest cover serves for the two slide valves the number of steam joints is reduced to a minimum. The wheels are cast iron, a somewhat unusual practice in England, and the spokes are H section.

The views are reproduced from photographs kindly furnished us by Mr. F. W. Webb, and show the cast-iron trellis path supporting the overhead traveling cranes, which are worked by the flying rope system first used at Crewe some 25 years ago.

Bridge Failures.

Mr. George H. Thomson, M. Am. Soc. Eng., Engineer of the New York Central, read an interesting paper on "Mechanical Pathology, Considered in its Relation to Bridge Design," at the recent meeting of the British Association at Bath.

He stated on the authority of the bridge engineer of the New York State Railroad Commission, Mr. Charles F. Stowell, who has spent much time officially in obtaining data

* See *Railroad Gazette*, Aug. 31, 1888.

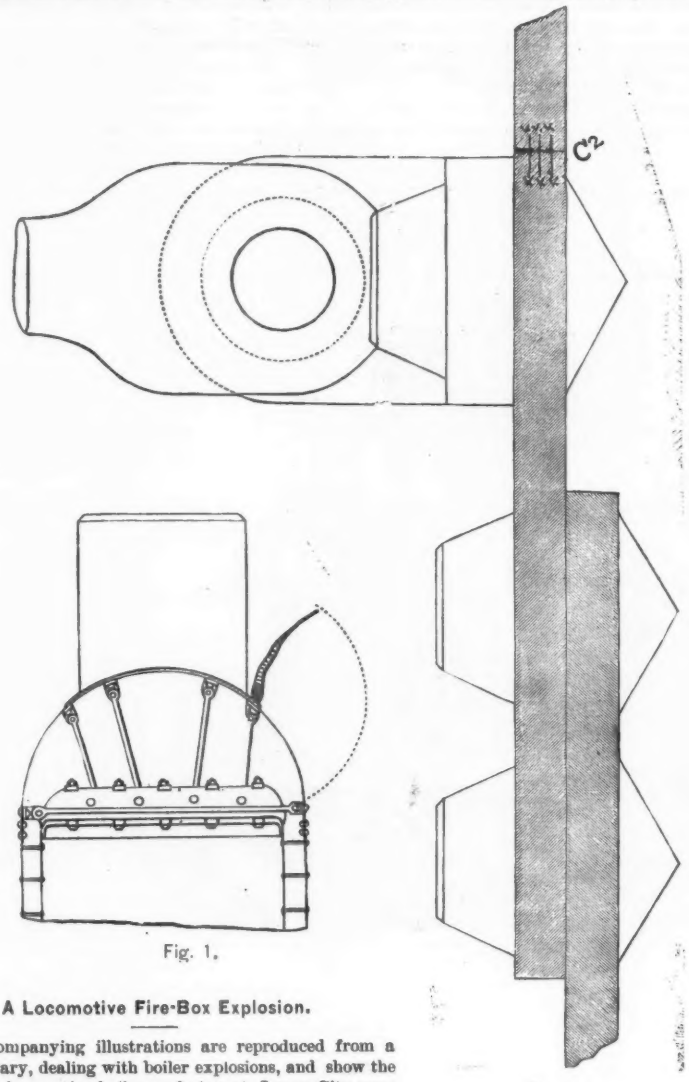


Fig. 1.

Fig. 2.

A Locomotive Fire-Box Explosion.

The accompanying illustrations are reproduced from a contemporary, dealing with boiler explosions, and show the causes of a locomotive boiler explosion at Jersey City some years since.

At the present time, when so many locomotive boilers are exploding, it is instructive to study authentic particulars of actual explosions, especially as the explosion was a typical instance, and there can be no doubt that numerous boilers explode from a very similar cause.

Fig. 1 shows a general view of the exploded boiler, the side sheet of the fire-box rupturing just at the water line, owing to a deep furrow, which is shown on a larger scale in figs. 2 and 3.

Fig. 2 is a vertical section showing the attachment of the braces. The furrow occurred at the point C^2 just above the brace, and is more clearly shown in fig. 3, which is a section on a horizontal plane through the furrow. The dark shading shows that for a considerable distance the furrow extended nearly through the plate, and is so clearly the cause of the rupture that few would venture to hint at low water.

The cause of the furrowing is very evident. The foot of the brace stiffens the shell of the fire-box, and owing to the sudden change the bending action under pressure is concentrated just above the brace where the plate has to resist any bending action unassisted. The plate is thus bent backwards and forwards every time steam is raised. The sharp bend at one point flakes off the scale and the water attacks the fresh metal thus exposed to corrosion. The result is the grooving shown in the engravings. This most fertile source

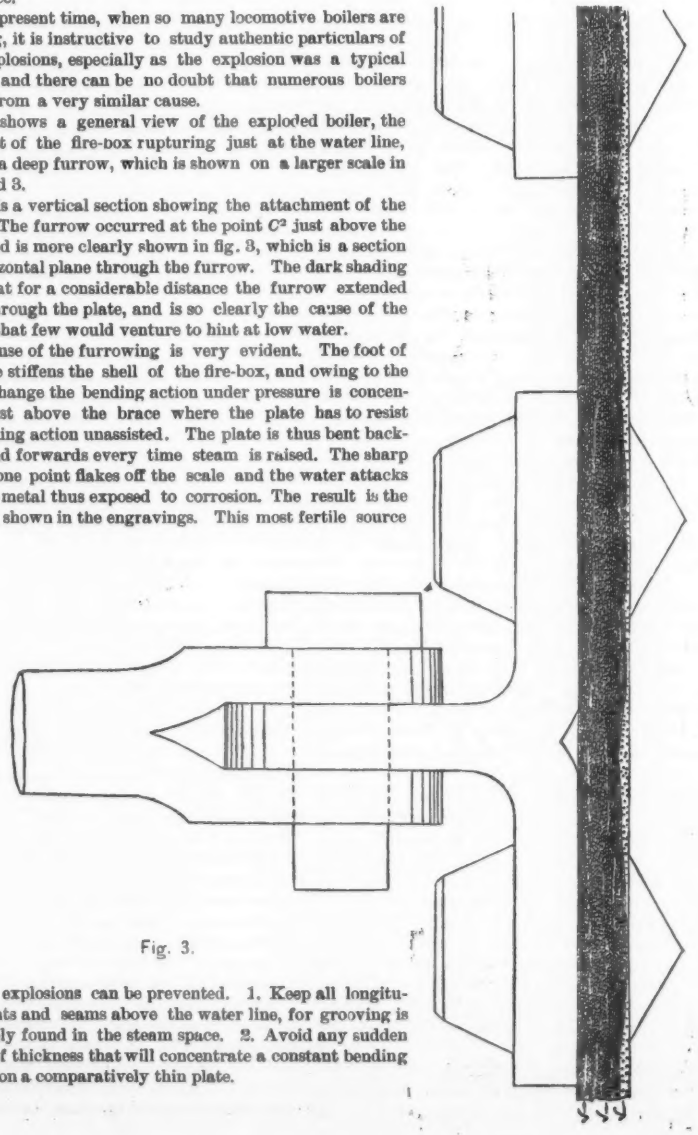


Fig. 3.

of boiler explosions can be prevented. 1. Keep all longitudinal joints and seams above the water line, for grooving is very rarely found in the steam space. 2. Avoid any sudden changes of thickness that will concentrate a constant bending action upon a comparatively thin plate.

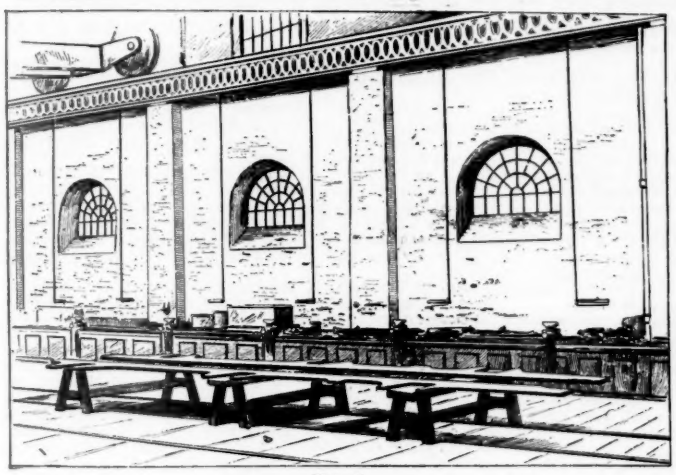


FIG. 1.
COMMENCEMENT.

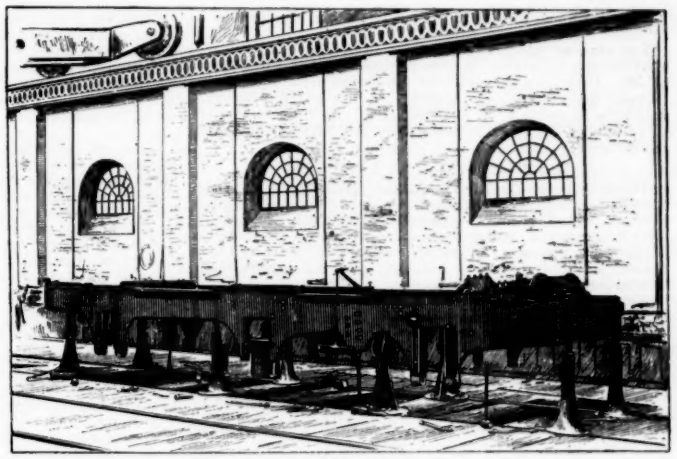


FIG. 2.
CYLINDERS IN POSITION. 6¼ HOURS' WORK.

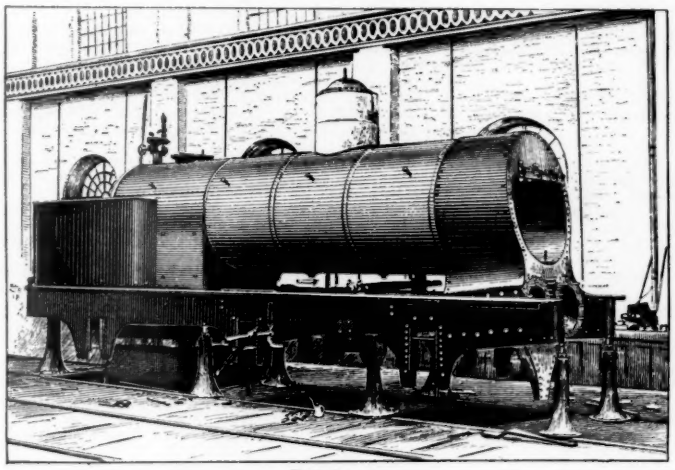


FIG. 3.
BOILER IN POSITION. 16 HOURS' WORK.

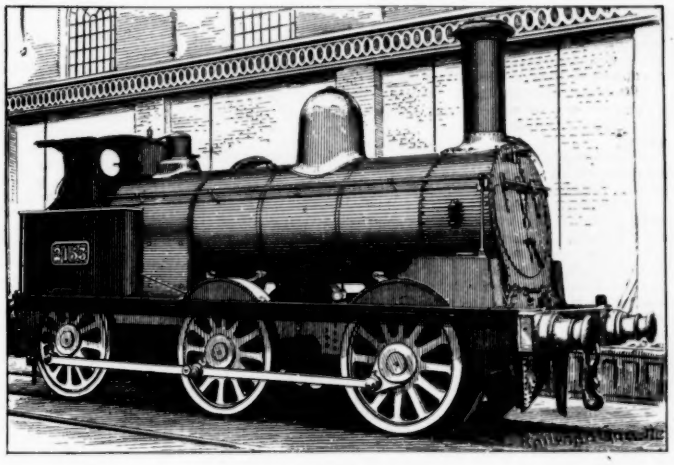


FIG. 4.
COMPLETION. 25½ HOURS' WORK.

ERECTING AN ENGLISH LOCOMOTIVE.—CREWE WORKS, LONDON & NORTHWESTERN RAILWAY

FEB. 4, 5 AND 6, 1888.

of fact and cause, that at least 251 railroad bridges failed in the United States and Canada during the ten years, 1878-87, from weakness, overwork, collision, etc. The number embraces only truss bridges, as distinguished from simple stringer and trestle bridges, and includes only those failures which involved the wreck of the whole or part of a train, and resulting directly from the presence of a train on a bridge. It is intended to cover only such accidents to railroad truss bridges as foresight in design, construction or maintenance might have been expected to have prevented, unless some of the accidents due to the failure of a bridge in consequence of its abutments being undermined by a freshet, be considered beyond human foresight. The list does not include such accidents as that at Chatsworth, which was due to the failure of a trestle bridge, nor that at White River Junction, as the burning of that structure was not the cause of, but rather the result of an accident, the fire being communicated by the burning train already wrecked. The list does not include any bridge destroyed by the course of nature, as by lightning, cyclones, floods, or fire, unless a train was on and went down with the bridge. If failures due to all these causes were considered, the list would be much longer.

Of the number 251, above quoted, 57 were knocked down by derailment, broken axles, etc.; 30 were "square falls," in 96 cases the real cause of failure was in a measure uncertain; 5 failures occurred during replacement or repairs.

CAUSES OF BRIDGE FAILURES.

The principal causes of bridge failures were broken car axles, increased weight of engines, increased number and weight of cars, increased speed of trains, and consequent increased brake power, and the difficulty of ascertaining the strains caused by the last mentioned causes. The causes are considered in detail below:

The pathology of the broken axle and of a bridge structure is nearly correlative.

A Master Car Builders' Standard axle under a fully loaded car deflects at the centre about $\frac{1}{30}$ in., with an extreme fibre stress of 15,000 lbs. per sq. in., or counting both ways the deflection could be stated to be about $\frac{1}{15}$ in., and a stress ranging from 20,000 lbs. to 30,000 lbs. per sq. in.

Very elaborate experiments have been made at the United States Arsenal, at Watertown, Mass., to ascertain the injury to axles of a record of 95,000 miles. These tests are purely "laboratory" (elastic limit, ultimate elongation, etc.), and they indicate little or no injury to the quality of the iron from the 95,000 mileage.

Recent tests (of a character not strictly speaking "laboratory") have been made with iron axles, taken from cars of two years' service on the New York Central (this company removes axles on passenger coaches, as well as side bars to locomotives, every two years, the exact mileage therefore unknown). Such axles will give good laboratory tests, but the test here stated is known as the "drop," 1,650 lbs. falling 10 ft., striking the axle at centre. The axles were supported on thin bearings and 3 ft. apart, 1½ ft. each from centre of axles. Two blows usually fracture the axles like glass, not at the centre or between the bearings, but at the filleted end of journals, and yet these worn axles if annealed are not more easily fractured than new axles. Query: What can the laboratory tests teach us regarding the pathology of axles?

The increase of weight coming upon axles, due to increase of car capacity, with little or no accompanying increase to size of axles, already too small, must lead to catastrophes in the future.

An attempt, extending through several years, to ascertain the probable chance of collision on bridges due to broken axles discovers that an axle is more apt to break on a bridge than in any other spot on a railroad.

On the New York Central, during the year 1887-8, there were removed from freight and passenger cars 31 axles, on account of broken, bent or other defects, and the number of axles in service for that period was 104,000. Several years ago this record was "large," and the study of mechanical pathology has reduced the breakage to the above reasonable figures. Upon this line, in the time mentioned, four axles broke upon bridges. One accident destroyed 28 cars and contents, and another occurred in front of an incoming passenger train on another track, where the possibilities of a great catastrophe were imminent, which, happily, the application of brakes prevented.

The danger ahead from broken axles appears to be sufficient to warrant the earnest and thoughtful consideration of those interested in the maintenance of railroad metallic bridges, and here might be urged the necessity of making allowance for these accidents, these pathological conditions, to come from the broken axles of the future.

Regarding the pathology of wheels, during the year 1887 the Grand Trunk Railway of Canada discarded for breakage and cracks 2,333 cast-iron wheels out of 109,564 in use.

The tendency to increase the capacity of cars, and consequent gross tonnage, has been general in America. Freight cars now average a uniform load of 1½ tons per lineal foot, and coal cars have been designed that weigh with load over 3,600 lbs. per lineal foot, though of this latter class few are in use.

In no way is the progressive tendency of the science of transportation more marked than in the increase in power, whether for passenger or freight service.

The weights of some recent engines were given as follows:

	American type. Lbs.	Ten-wheel. Lbs.	Consolidation. Lbs.
Forward truck	30,700	30,000	15,000
First pair drivers	45,680	33,000	33,000
Second " "	48,010	33,000	33,000
Third " "	.....	34,000	36,000
Fourth " "	.....	.....	34,300
Total engine, working order	124,390	130,000	151,300
" " and tender	197,390	.....	224,300
Cylinders	20 × 24	19 × 24	22 × 28
Driving wheel base	7 ft. 6 in.	.....	.....
Total wheel base, E. and T.	49 ft. 3½ in.	.....	.....

The ten-wheeler is for passenger service and the Consolidation is intended for special service on a mountain grade.

Consolidation engines are favorites on many lines, but it is improbable that they will be the freight engines of the future for all, especially lines of easy gradients. They are not economical engines where a speed of 25 miles and over must be maintained. Recent trials of Consolidation engines in actual service on the New York Central (a line of easy gradients generally), for a speed of 25 miles demonstrated their inefficiency. The new freight engines for the West Shore are "ten-wheelers."

It is generally considered that freight must be moved at increased speed. On the New York Central the speed has been increased twice upon the four-track division, extending from Albany to Buffalo. In 1874 the speed for freight trains was limited to 15 miles per hour; in 1880 increased to 20 miles per hour. At present the speed is about 25 miles per hour, and with this speed the east-bound "through freight" car movement, about all on the east-bound freight track, varies from 34,000 to 46,000 loaded cars and 600 to 1,900 empty cars per month. The loaded cars will average 28 net tons gross load each.

The power of the future must be not only able to move trains with dispatch, but must start with trains without delay; and further, such power must be able to reduce a speed, and to stop with train under control within some limit as to the distance traveled. All this will involve great concentration of weight in the drivers, together with engine power brakes—which later device is a medium for the transmission of more mechanical work to a structure than engineers are prepared at present to admit, but cannot altogether ignore. A recent failure of a bridge in the state of New York was due to the power brake. In this case a heavy engine had been detached from the train to take a side track, the switch being at the end of the bridge. The trusses failed by collapse of the top chord and the compression members. This bridge had been condemned by the state authorities.

While those interested in the sale of bridges are satisfied to design from a purely strain-sheet basis, those that maintain, use, and repair them, are often inclined to doubt as to whether the present methods of estimating the magnitude of the forces at work in the various members of a metallic structure, due to live loads alone, and the determination of sections thereform, are adequate to meet the future needs of railroad operation.

While engineers are agreed as to the nature and extent of stresses due to static loading, there is some difference of opinion regarding the character and quantum of the forces set at work by the effort of engines in pulling, power brakes, engine reversals, etc.

From gauge experiments made by the writer from time to time on various types of bridges at work, it is manifest that the dimensioning of structures from the strain-sheet forces is open to criticism. Thus in a pin-connected bridge of short span, the strain sheet shows the maximum stress on a counter rod, due to live load alone, to obtain when the first driving axle of 14 tons arrives at the foot of the rod, and the stress to be at the rate of 8,000 lbs. per square inch, and the gauge so indicates when the engine is quietly imposed; but when the last axle of the last car of a train, running in an opposite direction, and with the inclination of the rod, arrives at the foot of this rod, the weight imposed being one-half that due to the engine driver, then the gauge shows a stress of from 15,000 lbs. to 24,000 lbs. per square inch for speeds of 30 to 45 miles per hour, instead of 4,000 lbs. per square inch, which the strain sheets should have shown.

In another pin-connected bridge (double track, with two trusses where the pins of 3⅛ in. in diameter are relatively small, on account of the wide packing of the lower chord eyebars, four on each side of the centre of truss), if the usually accepted theory of pin bending is correct, there would then be flexures of the pins, and consequent unequal distribution of stress in the chord eyebars due to dead load alone, but the bars are equally strained, that is to say, by "sounding" them; hence no pin bending inferred.

Placing gauges on the outer (fourth) and inner (first) bars, an engine and tender of total weight of 66 tons, running on track nearest the truss gauge, weighs the stresses as follows: Outer bar at the rate of 50 lbs. per square inch, inner bar at the rate of 1,970 lbs. per square inch, or the inner bar does 39 times the live load work of the outer bar. With two engines the following result: Outer bar at the rate of 99 lbs. per square inch; inner bar at the rate of 3,780 lbs. per square inch, or 1 to 38.

One heavy passenger engine gauges a stress of 3,800 lbs. per square inch on inner bar. To load this bridge to its cal-

culated capacity, four heavy and four 66-ton engines will be required.

The unequal distribution of forces present in eyebar chords may be due in part to the bars themselves, or to the action of the eccentrically-connected and engine-lurched lateral system, which generally attaches to the chord indirectly, through the medium of a swing (*i. e.*, the hangers); or the stretching of the chord is opposed by the parallel longitudinal stringer.

EXAMPLES OF BRIDGE FAILURES.

The pathology of bridges is further illustrated in a bridge failure due to a "broken axle." Sooner or later all through bridges probably must withstand some kind of collision. This bridge was a heavy first-class structure, calculated to support two heavy consolidation engines followed by heavy trains. The floor was very strong, yet the bridge failed within forty days after its erection.

Another bridge fell through an accident, which the falling bridge was not adapted to withstand, though it could sustain trains of heavy engines and cars. A cow standing upon the bank at the end of the bridge was struck by the engine and thrown against the post. One member falling, all fell. A compression member of a pin-connected bridge as now constructed, when broken in the middle, can be compared to a cartwheel where everything has been removed save the hub and one spoke; both revolve around its centre. The pins did not break in this bridge.

Another bridge failure illustrates the error in relying upon pure mechanics in bridge design. This bridge was erected in 1879, and failed in 1886, with resultant loss of life, personal injury, etc. The span was 215 ft., and none of the pins or eyebars in the bottom chords were broken. It is claimed that the bridge had been overloaded, and doubtless this is true, but with ordinary loading it was a question of time, and only a question of how many tons, and how often applied. The tonnage up to date had been inconsiderable. The designer here sank in that quicksand formula:

$$\frac{\text{The stress per diagram}}{\text{A unit stress}} = \text{the proper amount of section required.}$$

A broken post caused by a single derailed flat car produced a failure of a first-class heavy pin-connected bridge, of excellent design and workmanship. The adjoining span exhibits the type, and the flimsy top lateral system so common to bridges of this type is there shown, together with its light portals. These portals ordinarily support a cast plate, with date and name of maker—a quotation from Dante would sometimes be more appropriate. In one place only has the designer recognized that the life of a bridge, like other things, is subject to all the uncertainties of existence, that is, in the collision strut extending from the first pin of bottom chord to the middle of the end post. This bridge fell within 48 hours after erection.

A failure due to limited head-room was caused by a steam derrick striking the portal column, thus lifting the castings off the top of end posts. This bridge is representative of a type now (happily) becoming obsolete. All the top chord pieces are made of wrought iron, but at the panel points there are cast-iron blocks holding the pins. This style of construction has still some honest advocates. While everything is smooth, such structures will stand up to work, but a slight collision tumbles them.

The failure of the Bussey Bridge was due to an imperfect hanger, 23 passengers being killed and over 100 wounded.

IMPROVEMENTS IN BRIDGE CONSTRUCTION.

Much progress has been made in the last 15 years, both in the design and manufacture of pin-connected bridges, and the invasion of rivets in the details has been so gradual and complete that there is not much of the original type remaining, except the long panels, and in some cases the loose lateral systems. The more improvement, the more rivets used, and this is shown in the recently erected Poughkeepsie Bridge, where the long spans are riveted lattice bridges, with main connections of web to chords done in pins, held by thickening plates reinforced by rivets; and where also the lateral system is done in the rigid, with rivet connections after the method of the American lattice bridge of the last twenty years. The gradual adoption of riveted work in America is well exhibited in the plate girder bridge. Fifteen to twenty years ago the plate girder was "too heavy," "too clumsy," "unscientific," and "the strains were uncertain" as to amount and direction. The plate girder, up to 80 ft. spans, is now recommended by all advocates of pinned connections, and the relatively heavy floor systems now current in America, taken with the riveted chords, etc., often make the weight of rivets 4½ per cent. of the whole structure.

Train Accidents in August.

COLLISIONS.

REAR

4th, on New York, Lake Erie & Western, near Pond Eddy, Pa., a coal train broke in two and the rear section ran into the forward one, wrecking 18 cars.

5th, on Missouri Pacific, near Boles, Mo., passenger train ran into the rear of a freight train, damaging the engine and caboose.

6th, on Wisconsin Central, near Hurley, Wis., a freight train ran into the rear of a construction train, doing considerable damage, and killing a trainman.

7th, night, on Cleveland, Akron & Columbus, at Gambier, O., a freight train ran into a box car which had been blown out of a siding on to the main track, demolishing an engine and 7 cars; brakeman seriously injured.

9th, on Hannibal & St. Joseph, near Hannibal, Mo., freight train ran into preceding freight, doing considerable damage.

9th, on Missouri, Kansas & Texas, near Chetopa, Kan., a passenger train collided with some freight cars which a high wind had blown out upon the main track from a siding, doing some damage.

10th, night, on Baltimore & Ohio, at Chester, Pa., a fast stock train ran into the rear of a freight train, wrecking the engine, caboose and about a dozen cars.

10th, on Denver, Utah & Pacific, near Canfield, Col., a passenger train collided with 2 loaded coal cars which were being run down grade out of a spur to the main track, overturning and badly damaging the engine; engineer killed, fireman injured.

11th, on Pittsburgh, Fort Wayne & Chicago, in Chicago, Ill., a passenger train ran over a misplaced switch and into a freight train standing on a siding, damaging engine and several box cars.

11th, on Central of Georgia, near Grovetown, Ga., freight train ran into a preceding freight, damaging engine and caboose.

11th, night, on Oregon Railway & Navigation Co.'s road, near Pendleton, Or., freight train broke in two and the rear section ran into the forward one, wrecking 10 cars.

12th, on Louisville & Nashville, near Gracey's, Ky., freight train broke in two and the rear portion was run into by a following freight train, wrecking engine and several cars.

13th, on Nashville, Chattanooga & St. Louis, at Cortner's Station, Tenn., a freight train ran into a preceding freight, doing slight damage; 1 trainman hurt.

13th, on Pittsburgh, Cincinnati & St. Louis, at Cedarville, O., a fast express ran into the rear of a freight train, wrecking engine and 8 cars. The freight had been delayed in going on to a side track. Engineer and fireman injured by jumping.

13th, on Long Island road, in Brooklyn, N. Y., a passenger train which was detached from the engine and let down grade to the station, ran over a misplaced switch and collided with an empty passenger train standing at the station. The force of the collision drove the tender of the engine of the standing train through the brick wall of the station building, injuring a woman in a waiting room.

16th, on Central Pacific, at Oakland, Cal., freight train backed through a misplaced switch and into some freight cars standing on a siding, wrecking several of them.

16th, on Central of Georgia, in Atlanta, Ga., pay train ran over a misplaced switch and collided with a flat car, doing slight damage.

17th, 11 a. m., on Pennsylvania road, in Trenton, N. J., a train consisting of engine and 25 empty passenger cars ran into a preceding freight train standing on the bridge over the Delaware River, the caboose and one car of which were lifted by the engine, causing considerable damage and delay to traffic. The engine of the colliding train had no air brake connections, but the runner apparently ran at the same speed he was in the habit of making when the train was under his control.

17th, on Wilmington, Columbia & Augusta, near Nichols, S. C., a freight train ran into the rear of a passenger train. Two trainmen and 1 passenger hurt; 2 tramps killed and 1 injured.

17th, on New York, Lake Erie & Western, near Kimball's, Pa., freight ran into rear of preceding freight, killing 1 trainman and injuring 3 others. The rear brakeman, who should have signaled, went to sleep on the caboose.

18th, on Pennsylvania, at Frankford Junction, Pa., freight train ran into the rear of a preceding freight, wrecking 3 cars.

23d, on Baltimore & Ohio, at Alpsville, Pa., passenger train ran into some freight cars which had been left standing on the main track, wrecking engine and 5 freight cars.

23d, on Boston & Albany, at Chestnut Hill, Mass., freight train ran into the rear of a preceding freight, derailing and damaging the engine, caboose and several cars.

23d, on Pennsylvania, near Asbury Park, N. J., passenger train ran over a misplaced switch and into the rear of a freight train standing on a side track, wrecking engine, caboose and 6 cars.

23d, on Long Island, near Hollis, N. Y., freight train broke in two and the rear section ran into the forward one, wrecking 3 cars and derailing 5 others.

24th, on Boston & Maine, in Boston, Mass., switching freight broke in two and the forward portion collided with some freight cars in front of it before the speed could be controlled. A brakeman was hurt.

27th, on the Pittsburgh & Western, near Lowellville, Ohio, a freight train ran into the rear of preceding freight, derailing engine and 10 cars and piling them up in a bad wreck. The foremost train had stopped on account of the failure of the engine. The flagman, who was asleep in the caboose, was killed and 2 other trainmen were injured.

27th, 2 a. m., on Pennsylvania, near Stafford, Pa., freight train of 45 cars broke in two in descending a grade and the rear section ran into the forward one, wrecking several cars. One of the wrecked cars contained oil in barrels, which was ignited by friction and 13 cars were burnt up. Two tramps, asleep on the oil barrels, were fatally injured.

28th, on Southern Pacific, at San Jose, Cal., passenger train entering the yards ran over a misplaced switch and into some freight cars, wrecking two of them and disabling the engine.

29th, on the Rome, Watertown & Ogdensburg, at Theresa Junction, N. Y., passenger train ran into the rear of another passenger train standing on a side track, injuring 2 passengers. It is said that a defective switch was the cause of the collision.

29th, on Pittsburgh, Youngstown & Ashtabula, near Girard, O., passenger train ran into the rear of a freight train, damaging the engine and 3 freight cars. Several trainmen slightly injured. There was a dense fog at the time

29th, on Pennsylvania, at Millstone Junction, N. J., freight train broke in two and the rear section was run into by a following freight, doing considerable damage.

30th, on Cincinnati, Hamilton & Dayton, at Lima, O., a freight train ran into some cars standing on the main track, piling them up in a bad wreck.

30th, on Norfolk & Western, near Bellspring, Va., freight train ran into a preceding freight which had just figured in a butting collision.

30th on the Philadelphia & Reading, at Shamokin, Pa., a freight train ran into an empty engine standing on the main track. Both engines were thrown down a bank into the river.

30th, on the Baltimore & Ohio, at Annapolis Junction, Md., a train of express cars ran into the rear of a passenger train, injuring one passenger.

30th, on the Baltimore & Ohio, at Breathedsville, Md., a freight train ran into a freight car that had been run out from a siding onto the main track. Engine and 15 cars wrecked and fireman injured.

30th, on Indianapolis & Vincennes, at Martinsville, Ind., freight train ran into the rear of a preceding freight, doing considerable damage.

30th, on New York Central & Hudson River, at Rochester, N. Y., mixed train ran into the rear of a standing passenger train, damaging the pilot of the engine.

30th, on the New York, Lake Erie & Western, at Addison, N. Y., freight train ran into the rear of preceding freight, wrecking a number of cars and blocking both tracks.

31st, on Denver, Texas & Fort Worth, at Beshoar, Col., the speed of a freight train descending a heavy grade got beyond control and it collided with some freight cars standing on the main track, wrecking engine and 3 cars. One trainman fatally injured by jumping.

31st, on the New York, Lake Erie & Western, at Owego, N. Y., freight train ran over a misplaced switch and into some cars standing on a side track. The engineer was injured by jumping.

31st, on the Chicago, Burlington & Quincy, near Creston, Ia., freight train ran into the rear of a preceding train, which had been derailed, wrecking 8 cars. The rear car of the forward train was a passenger car, from which a large number of passengers barely escaped before the collision.

BUTTING

1st, on Newport News & Mississippi Valley, at Olive Hill, Ky., butting collision between an engine hauling a caboose and a helping engine returning from the top of a grade. Both locomotives were totally wrecked; 3 trainmen killed and 3 injured. It is said that the runner of the helper failed to observe signals.

2d, night, on Baltimore & Ohio, at Hunt's Station, O., butting collision between a passenger train and a freight, due to a misplaced switch, wrecking both engines; 4 trainmen hurt.

2d, on New York, Lake Erie & Western, in Jersey City, N. J., collision between two switching engines disabled both.

7th, on Cincinnati, Indianapolis, St. Louis & Chicago, at Greensburg Ind., butting collision between two freight trains, wrecking the engines and several cars. The wreck caught fire and was consumed.

7th, on Columbus, Hocking Valley & Toledo, at Millville, O., butting collision between two freight trains, wrecking both engines and derailing 10 cars; 2 trainmen injured.

9th, near Zanesville, O., butting collision between Columbus & Eastern excursion train and Cincinnati & Muskingum Valley freight train, damaging both engines and several cars.

9th, on Burlington & Missouri River, at Crete, Neb., a fast freight ran into a standing passenger train, owing to misunderstanding of orders, wrecking the locomotives and several cars of each train.

11th, night, on Louisville & Nashville, in Decatur, Ala., butting collision between two freight trains.

12th, 2 a. m., on New York, Lake Erie & Western, at Magee's Switch, N. Y., a westbound passenger ran over a misplaced switch and into the head of a freight train standing on a middle turnout, badly wrecking both engines and several cars. One trainman killed and another trainman and several passengers slightly injured.

13th, on Illinois Central, at Portage, Ill., butting collision between two freight trains, wrecking the locomotives. One trainman injured.

14th, on Virginia Midland, at Culpeper, Va., butting collision between a passenger train and a freight, doing slight damage, injuring 1 trainman and 1 passenger.

14th, on Pittsburgh & Lake Erie, at Montour Junction, Pa., butting collision between two freight trains, wrecking the engines.

17th, near Findlay, O., butting collision between a New York, Mahoning & Western passenger train and a New York, Lake Erie & Western freight, damaging both engines and several cars. A passenger was slightly injured by jumping.

18th, on Texas & Pacific, near Cisco, Tex., butting collision between two freights, one of which was going in on a siding. Both engines and several cars demolished.

19th, on Ohio & Mississippi, near Carlyle, Ill., butting collision between two portions of a freight train which had broken in two. Two cars were damaged and fireman injured.

22d, on Toledo & Ohio Central, in Bucyrus, O., butting collision between a passenger train and an empty engine wrecked both locomotives; 1 trainman killed, 1 trainman and 3 passengers badly hurt.

24th, on Cincinnati, New Orleans & Texas Pacific, at Williamstown, Ky., butting collision between two freight trains, damaging both engines and several cars; 1 trainman slightly injured.

24th, on Galveston, Harrisburg & San Antonio, near Seneca, Tex., butting collision between a pay train and a freight, damaging both engines and 4 freight cars. One trainman injured.

25th, on Central of Georgia, at Clark's Hill, S. C., butting collision between two freight trains, disabling both locomotives; 1 trainman injured.

25th, on Grand Rapids & Indiana, near Muskegon, Mich., passenger train ran over a misplaced switch and into the head of a freight standing on a side track, damaging both engines and several cars.

26th, on Cincinnati, Hamilton & Dayton, in Cincinnati, O., butting collision between a local passenger train and a switching freight, disabling the engines and damaging several cars of each train. One passenger injured.

26th, on Lake Erie & Western, in Fostoria, O., butting collision between a freight train and a switching coal train disabled both engines.

27th, on the Chicago, Burlington & Quincy, near Krum, Ia., butting collision between a construction train which was running backwards and a freight, wrecking an engine and 10 cars. Three employés were killed and 4 injured. The construction train had been doing work 2 miles west of Krum, and had left a man at that station to flag all trains, but the flagman let the freight get by him.

28th, on the Cincinnati, Hamilton & Dayton, at Columbus Grove, Ohio, a butting collision between a freight and a special passenger train containing soldiers. The freight stopped on the main track and sent a flagman ahead to notify the passenger to take the side track, but the signal was not given or not seen, and the passenger train ran into the freight, wrecking several cars. Three passengers and 5 trainmen were injured.

29th, on Newport News & Mississippi Valley, near Clifton Forge, Va., butting collision between two freight trains, demolishing both engines and 4 cars; 3 trainmen killed, 1 hurt.

30th, on Burlington & Missouri River, at Omaha, Neb., butting collision between a freight and switching train, damaging both engines and several cars.

30th, on Norfolk & Western, near Bellspring, Va., butting collision between two freight trains, wrecking both engines and several cars; 1 trainman killed.

30th, on the New York, Lake Erie & Western, at Melrose, Pa., butting collision between two coal trains. One of the trains ran by the regular meeting point; a brakeman was killed.

30th, midnight, on Cleveland, Akron & Columbus, near Howard, O., butting collision between two freight trains, wrecking both engines and a number of cars; two trainmen badly hurt. The accident was due to a mistake in reading orders.

CROSSING AND MISCELLANEOUS.

1st, on New York & New England, at Bellingham, Mass., crossing collision between a passenger train and a freight train, damaging the engines and several cars of each train. It is said that the air brakes on the former failed to work properly.

1st, on Cleveland & Pittsburgh, at Rootstown, O., a freight train ran into the side of another freight just going on to a siding, wrecking an engine and 12 cars.

2d, at the crossing in Waterbury, Ct., a New York, New Haven & Hartford freight train ran into a New York & New England freight, damaging an engine and 1 car, and injuring one trainman.

9th, at the crossing near Avilla, Ind., a Baltimore & Ohio freight train collided with a Grand Rapids & Indiana freight, wrecking an engine and 10 cars.

12th, on Chicago, Burlington & Quincy, in Chicago, Ill., a freight train ran into a switching freight crossing the main track, demolishing several tank cars containing gasoline, which flooded the ground and caught fire from a live coal from the engine. The engine was badly damaged and 3 cars were consumed.

14th, at the crossing near Belmont, Pa., a Philadelphia & Reading freight train ran into a Baltimore & Ohio freight, damaging an engine and 4 cars.

15th, at Chicago, Ill., a Chicago, Burlington & Quincy passenger train ran into a Chicago, St. Louis & Pittsburgh train at the crossing of the two roads at Western avenue. The passenger engine and 4 cars of the freight were wrecked.

It is said that the air pipe had been maliciously closed between the tender and baggage car, thus making the air brake ineffective.

15th, night, at Chattanooga, Tenn., crossing collision between freight trains of the Western & Atlantic and East Tennessee, Virginia & Georgia. One trainman injured.

16th, at South Lawn, Ill., an Illinois Central passenger train ran into a Chicago & Grand Trunk freight train at the crossing of the two roads, wrecking the engine and 5 cars of the former, and 4 empty passenger and several box cars of the freight train. Six trainmen and 3 passengers injured. It is said that air brakes on the passenger train had become disarranged.

16th, crossing collision between a passenger train on the Chicago, Burlington & Quincy and a freight of the Chicago, Milwaukee & St. Paul at Western avenue, Chicago. Engine and 3 freight cars derailed.

20th, 5 p. m., on New York & Rockaway, at Hammel's Station, N. Y., collision between two passenger trains bound in the same direction at a point where two branches of the road converge. Both engines were damaged; 3 passengers injured. It is said that one of the runners disregarded a signal.

22d, on New York, Lake Erie & Western, at Conesus, N. Y., a freight train crushed into the side of another freight going into a siding. Engine and 6 empty coal cars wrecked.

24th, 9 p. m., at the crossing in Kylie, Tex., collision between a Gulf, Colorado & Santa Fe passenger train and a Denver, Texas & Fort Worth freight train. Both engines were turned around and badly damaged. One trainman injured.

24th, night, on Burlington & Missouri River, at Exeter, Neb., passenger train ran into the side of a freight train, disabling the engine and upsetting 4 freight cars. It is stated that a flagman displayed a wrong signal to the passenger train.

27th, a. m , at Enterprise, O., a Toledo, St. Louis & Kansas City freight train broke in two just before coming to a stop at the crossing of the Cincinnati, Jackson & Mackinaw tracks, and the rear portion ran into the forward one with such force as to shove it over the crossing and into the engine of a passing freight train. Both locomotives and 3 cars were badly damaged, together with several adjoining buildings.

29th, near Scranton, Pa., a Delaware & Hudson Canal freight train ran into a Delaware, Lackawanna & Western coal train at the crossing of the two roads, wrecking a number of coal cars. The collision happened in the night; there is no signal at the crossing, but a watchman is stationed at it in the day time.

DERAILMENTS.

DEFECTS OF ROAD.

1st, on Alabama Great Southern, at Birmingham. Ala., car of a freight train derailed by a defective switch and overturned.

2d, on Baltimore & Ohio, at Connellsville, Pa., switch engine hauling a freight car broke through a bridge over the Youghiogheny River. Five trainmen went down with the engine, but all escaped with slight injury. It is said that the timbers of the bridge were decayed.

6th, on St. Louis, Iron Mountain & Southern, in St. Louis, Mo., passenger train derailed by defective track.

6th, on Atchison, Topeka & Santa Fe, near Lawrence, Kan., an east-bound passenger train struck a broken rail and was thrown from the track into the ditch. The locomotive was wrecked, engineer killed and fireman badly scalded.

6th, on Mobile & Ohio, at Jackson, Tenn., 5 cars of freight train derailed by a broken rail.

7th, 5 a. m., on Hannibal & St. Joseph, near Kansas City, Mo., 11 cars of a freight train precipitated into Mill Creek by the giving way of a bridge. The track on the adjoining bridge of the Wabash was obstructed. The stream was swollen. This place was the scene of two similar wrecks May 23 last.

7th, on Union Pacific, near Lawrence, Kan., a culvert gave way under a passing freight, piling 7 cars up in a bad wreck.

8th, on Cincinnati, Indianapolis, St. Louis & Chicago, near Morgantown, Ind., baggage car and 1 coach of a mixed train thrown from the track by a broken rail, injuring 1 trainman and 17 passengers.

9th, on Georgia Pacific, at Cook's Springs, Ala., passenger train derailed and overturned, injuring several passengers. It is said that a defective switch rod caused spreading of the rails.

9th, a. m., on Pennsylvania road, in Newark, N. J., passenger train derailed, apparently by a defective frog. A signal tower was partially demolished and traffic delayed several hours.

13th, on Jeffersonville, Madison & Indianapolis, at Memphis, Ind., construction train derailed by the breaking of a cog in the drum which throws the switch rail. Several cars damaged; one trainman slightly injured.

14th, on Delaware, Lackawanna & Western, in Newark, N. J., engine of passenger train was derailed by a defective switch and collided with a yard engine on a side track, while the remainder of the train kept to the main track. The two forward cars were thrown crosswise of the track and damaged.

14th, on Louisville & Nashville, near Reeder's Station, Ala., 20 cars of a freight train were thrown from the track by the spreading of the rails, doing considerable damage. One trainman killed, 2 injured.

16th, on Delaware & Hudson Canal Co.'s road, at Howe's Cave, N. Y., passenger train thrown from the track by the spreading of the rails.

20th, on St. Louis, Arkansas & Texas, near Bird's Point, Mo., passenger train thrown from the track by a broken rail. The locomotive was overturned in the ditch. Engineer hurt.

20th, on Northern Pacific, at Sand Point, Idaho, engine and several cars of construction train were thrown from the track by a broken rail and went into the ditch; 1 trainman injured.

22d, on Columbus, Springfield & Cincinnati, at Seven Mile Bridge, O., a mixed train, consisting of engine, 8 flat and 4 passenger cars, was thrown from the track by a broken rail and overturned in the ditch, injuring 14 passengers.

24th, on Ohio River road, near Moundsville, W. Va., 4 cars of a freight train went through a trestle which had been weakened by heavy rains. Three laborers injured, 1 of them fatally.

26th, on the Union Pacific, at Kimball, Neb., fast passenger train derailed by broken rail, and 3 sleeping cars rolled down a bank. Three passengers injured.

26th, on Chicago & Northwestern, near Cedar Rapids, Ia., west-bound passenger train derailed by a broken switch, wrecking the engine and 2 cars; engineer and fireman badly hurt.

28th, on Louisville & Nashville, in Birmingham, Ala., several cars of a freight train were derailed by a defective switch, and collided with a freight on an adjoining track, damaging 3 cars.

29th, on Central of Georgia, near Upatoie, Ga., a freight train broke through a trestle bridge, wrecking 14 loaded cars.

29th, on the Baltimore & Ohio, at Mt. Vernon, O., several cars of a freight train were derailed and wrecked by an insecure switch.

31st, on Indianapolis & Vincennes, near Worthington, Ind., freight train thrown from the track by a broken rail.

31st, on Missouri Pacific, near Boonville, Mo., several freight cars in a mixed train thrown from the track by the spreading of the rails. A gang of section men was struck by the derailed cars; two were killed, two others were injured, and a tramp stealing a ride in a lumber car was crushed to death.

31st, on the Chicago, Burlington & Quincy, near Creston, Ia., a freight train with car-load of passengers at the rear was derailed and ditched by broken rail. The train was soon after run into by a following freight.

DEFECTS OF EQUIPMENT.

1st, on Northern Pacific, near Pasco, Wash. Ter., freight train derailed and partially wrecked by the breaking of a wheel.

1st, on the Cincinnati, New Orleans & Texas Pacific, near Somerset, Ky., freight train derailed by a broken truck, several cars going over an embankment, killing the conductor and 2 tramps.

2d, on Chicago, Burlington & Quincy, at Pacific Junction, Ia., several cars of a passenger train were derailed by a broken wheel and damaged.

4th, on Philadelphia & Reading, at Pennington, N. J., 5 cars of a freight train derailed by a broken axle and wrecked, injuring a brakeman.

8th, on New York Central & Hudson River, at Melrose, N. Y., 8 cars of a freight train were derailed and wrecked by the breaking of an axle.

11th, on Pennsylvania, at Whitehouse, Pa., 7 cars of a freight train derailed by a broken axle, and badly wrecked.

12th, on Atlantic & Pacific, near Siberia station, Cal., passenger train derailed by the breaking of a truck under a baggage car, doing some damage, injuring 1 trainman and several passengers.

13th, on Rome, Watertown & Ogdensburg, near Red Creek, N. Y., engine of freight train derailed by the breaking of the forward truck.

14th, on Alabama Great Southern, near Valley Head, Ala., several cars of freight train derailed by a broken truck

15th, on Chicago, Rock Island & Pacific, near Homestead, Ia., 5 cars of a freight train derailed by broken axle.

17th, on Boston & Maine, near North Boscawen, N. H., 5 loaded refrigerator cars thrown from the track and wrecked by the breaking of an axle.

18th, on New York, Pennsylvania & Ohio, near Youngstown, O., owing to the breaking of an axle 18 cars of a freight train were derailed and piled up in a very bad wreck. Two trainmen hurt.

24th, on the Lehigh Valley, at Ransom, Pa., a freight train derailed and piled up in a very bad wreck by the breaking of an axle. A coal train was passing on the adjacent main track at the time and that was also wrecked.

25th, on the Oregon Railway & Navigation Co.'s road near Blue Mountain, Wash. T., stock train derailed, while descending a steep grade, by a defective wheel, wrecking 9 cars of cattle. Two brakemen were killed.

27th, on the Denver & Rio Grande, near Petersburg, Col., freight train derailed by broken wheel. Eight cars were wrecked, and soon after taking fire were burned up.

27th, on Oregon Railway & Navigation Co.'s road, near La Grange, Or., a wheel under a car in a passenger train broke while descending a heavy grade. Three cars left the track, but the train ran about a mile before it could be stopped, owing to the derangement of the air brake connections and the air signal, by means of which communication between the cars and the engine was cut off.

28th, on the Central of Georgia, near Geneva, Ga., freight train derailed by broken wheel, most of the train going down a bank.

29th, on the Lehigh Valley, near Wilkesbarre, Pa., the engine of freight train exploded its boiler, killing the fireman, who was seated on the tender. The engine, tender and several cars were derailed and badly wrecked.

30th, on the Kentucky & Indian Bridge Railroad, at Louisville, Ky., 4 cars of a freight train were derailed on the elevated tracks and fell into the street. A defective truck is given as the cause.

NEGLIGENCE IN OPERATING.

4th, on Western North Carolina, near Asheville, N. C., 10 cars of a freight train were derailed and wrecked by a log falling from one of them upon the track. An employé standing near the track was struck and injured by a piece of timber.

5th, on St. Louis, Arkansas & Texas, near Jonesboro, Ark., passenger train thrown from the track by a misplaced switch and overturned in the ditch. Fireman killed.

7th, on Pennsylvania road, near Mapleton, Pa., a car heavily loaded with stone became unmanagable in making a flying switch, and jumped the track at the entrance of the bridge over the Juniata River. A light tressle, upon which 6 men were engaged in erecting stone piers for a new bridge, was thrown into the river, killing 2 laborers and injuring 4 others.

7th, on Pittsburgh, Cincinnati & St. Louis, at Wilson's Switch, W. Va., a tie fell from a car in a freight train, throwing 3 cars from the track.

8th, evening, on Baltimore & Ohio, in Philadelphia, Pa., an empty engine moving backward ran through the open draw of a bridge over the Schuylkill River. The fireman first observed the danger and escaped with slight injury by leaping into the stream, but the runner and 2 employés went down with the engine. The engineer and one of the others were drowned, while the third man was severely injured. The regular signals were out of order and a common red lantern was used to stop trains. The bridge tender says that the red lantern was properly displayed while the men on the engine claim that it was not.

8th, on Illinois Central, near Medon, Tenn., freight train derailed by a misplaced switch, fatally injuring the engineer and fireman.

10th, on Lehigh Valley, at Weatherby, Pa., a train of 150 loaded coal cars descending a grade became uncontrollable. The engineer cut loose from the train, ran ahead and set a switch to throw the train on to a side track. The speed was so high, however, that a large number of the cars were piled up in a very bad wreck. The engineer said that wet track was the cause of the trouble.

10th, on West Jersey, at Manumuskin, N. J., passenger train derailed by a misplaced switch. A passenger in attempting to jump through a window was badly cut by broken glass.

11th, on New York Central & Hudson River, near Niagara Falls, N. Y., engine of passenger train derailed by a misplaced switch and overturned. Engineer hurt by jumping. It is said that a brakeman of a preceding freight had to either leave the switch wrong or lose his train, and he chose the former.

13th, on Camden & Atlantic, in Camden, N. J., the air brakes on a passenger train approaching the station "failed to work properly" and the train was not stopped in time to prevent the engine dashing through the gates and damaging the station platform.

21st, on Chicago & Alton, at Towanda, Ill., freight train ran over a misplaced switch and was derailed, 4 cars being wrecked.

22d, on St. Louis, Arkansas & Texas, near Jonesboro, Ark., passenger train derailed by a misplaced switch and ditched. Fireman killed and engineer injured.

23d, on Central of Georgia, in Montgomery, Ala., engine of freight train derailed and ditched by a misplaced switch.

31st, 7:30 p. m., on Chicago, Burlington & Quincy, in Chicago, Ill., switching freight train was backed off the end of a spur, demolishing a house, injuring one of its occupants.

UNFORESEEN OBSTRUCTION.

1st, on Atlantic & Pacific, near Holbrook, Ariz., a freight train ran into a washout, piling up the engine and 10 cars in a bad wreck, which caught fire and was partially destroyed. One trainman killed, 3 injured.

1st, on Alabama Great Southern, at Birmingham, Ala., engine of freight train derailed by a purposely misplaced switch.

3d, on Ohio, Indiana & Western, at Brownsburg, Ind., freight train derailed at a switch which had been maliciously obstructed.

3d, on West Virginia Central, near Westernport, Md., engine of passenger train derailed by running over a cow and thrown over an embankment, injuring the fireman.

5th, 3 a. m., on Charlotte, Columbia & Augusta, near Charlotte, N. C., passenger train derailed and engine and several cars badly damaged by obstructions placed on the track by train wreckers. Five trainmen and 2 passengers injured, one of the former fatally.

6th, on Delaware & Hudson Canal Co.'s road, near Saratoga, N. Y., passenger train ran into a large bowlder which had been maliciously rolled upon the track, disabling the engine.

6th, on Atchison, Topeka & Santa Fe, near Lawrence, Kan., passenger train ran into a landslide, derailing the engine and one car.

7th, on Houston & Texas Central, near Ross, Tex., a mixed train was thrown from the track at a point where the bars of a cattle-guard had been torn up by miscreants and fastened on the track. Engine and 10 box cars were piled up in the ditch in a very bad werck, but two passenger cars at the rear remained on the track. Engineer killed, fireman and several passengers injured.

7th, on Michigan Central, near Slocum Junction, Mich., engine, baggage car and 2 coaches of an excursion train thrown from the track by the spreading of the rails at a point where the roadbed had been impaired by freshet.

7th, 1 a. m., on Southern Kansas, near Benedict, Kan., passenger train ran into a tree which had been blown down across the track and the engine and several cars were derailed and overturned in the ditch. One trainman and 2 passengers injured.

9th, night, on St. Louis, Iron Mountain & Southern, near Fulton, Ark., construction train moving backwards ran over a cow, derailing the entire train; 1 trainman killed, 2 injured.

10th, on Mobile & Girard, near Columbus, Ga., a freight train was derailed by sand which had been washed upon the track by heavy rains, wrecking several cars. The locomotive boiler exploded, and the engineer and firemen were hurt.

11th, on Providence & Worcester, in Providence, R. I., engine of switching freight derailed by a purposely misplaced switch.

13th, 1 a. m., on New York, Lake Erie & Western, near Shohola, Pa., an east-bound freight train struck a mass of earth and rock which had been loosened by heavy rains and fallen down upon the track, throwing the engine and several cars over so as to obstruct the adjacent track. Three trainmen seriously injured.

13th, about 1 a. m., on New York, Lake Erie & Western, near Shohola, Pa., a west-bound fast express train into the wreck of an east-bound freight train, which had just been thrown over from the adjacent track by a landslide. The road at this point runs alongside of and about 80 feet above the Delaware River. The engine and first 5 cars, including a coach and a carload of horses, were precipitated down the bank, where the wreck caught fire and burned up. The fireman was caught under the engine and burned to death, and 6 trainmen and 27 passengers were injured. It is thought that the fire originated from the stockmen's lanterns and hay in the car loaded with horses, 12 of which were killed.

15th, on Central Pacific, near Halleck, Nev., freight train derailed by a washout.

16th, on Chicago, Milwaukee & St. Paul, near Emmettsburg, Ia., freight train derailed by cattle on the track and a number of cars wrecked.

18th, on New York Central & Hudson River, at Amsterdam, N. Y., engine and 5 cars of switching freight derailed and ditched by a purposely misplaced switch.

21st, on Cincinnati, New Orleans & Texas Pacific, near Nemo, Tenn., passenger train derailed by a tree which had been blown down upon the track in a cut. Nearly all the cars were badly damaged, being hurled from side to side against the rocks. Four passengers injured.

21st, on New York & New England, near Putnam, Conn., freight train derailed by a washout; 1 trainman fatally injured.

22d, on St. Louis, Iron Mountain & Southern, near Malvern, Ark., passenger train derailed by a piece of iron which had been maliciously placed in a frog, ditching engine, tender and baggage car.

23d, night, on Chicago & Northwestern, near Beloit, Wis., passenger train struck a cow, derailing the engine.

24th, on West Shore, near Esopus, N. Y., a large bowlder rolled down upon the track in front of a north-bound passenger train, and the engine and 4 cars were derailed and damaged.

26th, night, on St. Paul, Minneapolis & Manitoba, near Fort Buford, Dak., stock train ran into a herd of cattle, and the engine and 17 cars were derailed and badly wrecked, killing 100 head of cattle; 5 trainmen injured, 3 fatally.

27th, on the St. Louis, Arkansas & Texas, at Tyler, Texas, engine of freight train derailed by sand which had been washed on the track at a street crossing. Engineer killed.

28th, on Louisville & Nashville, at Thompson's Station, Ala., passenger train ran into a tree which had been blown down across the track. Pilot of the engine was knocked off.

31st, on Texas & Pacific, near Sulphur, Tex., freight train derailed by cattle on the track, injuring the engineer.

UNEXPLAINED.

1st, on Baltimore & Ohio, near Barnesville, O., freight train derailed and about a dozen cars thrown into the ditch and badly wrecked. Three tramps injured, 1 fatally.

3d, night, on Cincinnati, Sandusky & Cleveland, near Carey, O., freight train derailed and partially wrecked.

6th, on Cincinnati, New Orleans & Texas Pacific, near Somerset, Ky., passenger train derailed on a trestle.

6th, on New York Central & Hudson River, in Rochester, N. Y., coal train derailed.

7th, on New York Central & Hudson River, at Albany, N. Y., freight train derailed, disabling the engine and damaging several cars.

7th, on Cincinnati, Hamilton & Dayton, near Brighton, O., 6 cars of a freight train derailed and ditched.

7th, on Columbus & Western, near Goodwater, Ala., ca-

(*Continued on page 642.*)

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

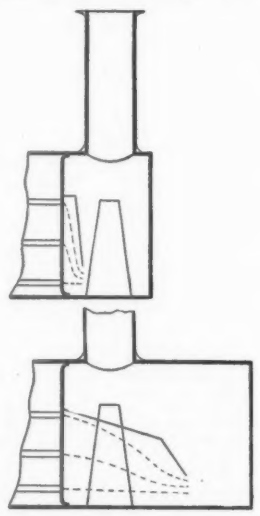
Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The approaching meeting of the American Society of Mechanical Engineers at Scranton promises to be interesting, the subject of the phenomena attending the use of steel under various conditions being especially calculated to bring out some suggestive experiences.

The paper on "Bridge Failures," which we reproduce in a slightly condensed form in another column, contains some interesting reading for the designers of locomotives and rolling stock. Mr. Thomson finds from practical experience and actual statistics that a large number of bridges fail because a broken axle allows a derailed car to come into collision with a bridge and knock it down, with the general consequence that the train in wrecked, traffic seriously delayed, and last, not least, some lives are lost. The importance of having axles of ample strength, well filleted at all sudden changes of diameter has been urged in these columns, and the fact that an extraordinarily large proportion of axles fail at or near bridges adds force to our remarks. It is a t ifle difficult to understand why axles should have a greater tendency to break on bridges, but the probability seems to be that the change in the nature of the road bed is the cause of the mischief. Brunel always believed in laying ordinary ballast over all his bridges, and even his Saltash bridge, two spans of 460 ft. each, is ballasted throughout. His aversion to any special support for permanent way appears to have been founded upon reason, and though the weight of the ballast considerably increases the dead load on the bridge, it seems worth while considering, whether the more even elasticity of the roadbed would not save many broken axles, while the weight of the ballast would add to the inertia of the bridge and thus mitigate the effect of the blows caused by the sudden application of the load. As might be foreseen by mechanical engineers, Mr. Thomson found by actual test that the strains shown by strain sheet calculations for stationary loads were largely exceeded when the trains moved at even a moderate speed, and when tested by this method the value of a heavy floor admits of little doubt.

An experienced trainman tells, in another column, of some of the characteristic behavior of freight conductors and others. He doubtless refers chiefly to the practice on his own road, but communications that we occasionally receive from various localities indicate that this writer is not in a specially careless locality. Ingenuity in devising ways to get home early is common to all regions. Keeping the train in motion while orders are asked for is "all right" at some places; perhaps at others it is not. The reason for requiring the engineman to read his order before he *starts* is that, if allowed to proceed, *some* runner will some time go too far before stopping to look around for the conductor. Of course, with a strict requirement that both should go to the telegraph office this question does not come up in this shape; but it seems that the majority of the Time Convention committee believe that such a requirement involves too much delay. Conductors who permit brakemen to sign for them should be checked by the operator. This shows incidentally the need of having in the telegraph office persons of character, rather than mere boys and girls. The telegraph service of this country has a remarkable record of fidelity, and, in many respects, efficiency; but it is not certain that this favorable condition will continue indefinitely. Operators not only have duties requiring good judgment and other business qualities; they are confidential clerks of the managers of the road, and therefore should be selected with care and paid more than they are. Present rates on most roads preclude anything like permanency, as a rule. "Langdon's" whole letter enforces the need of closer inspection; for we infer that the bad practice he refers to was not on an insignificant road by any means. It is not to be supposed that continued recklessness such as he describes goes on wholly unsuspected by the superintendent; but many of these officers should give the benefit of the doubt oftener to the company and less frequently to the men. The latter plan is easier for the superintendent, but involves a risk to his reputation. When there is a doubt whether a certain person or place needs to be investigated, *investigate*.

The principal reason why deflectors cannot be profit ably employed in ordinary smoke-boxes of limited size is shown by the accompanying diagram. In the extended smoke-arch the draft is equalized and fairly distributed among all the flues, while in the small



smoke arch, the deflector, being so near the flue sheet, concentrates the draft on the lower flues. It will be seen that the course of the draft from the upper flues is very indirect and circuitous, and that were the deflector moved still nearer the flue sheet, the draft from the upper flues would be entirely stopped.

Locomotive Fire-boxes and Boiler Explosions.

On another page will be found a letter from a correspondent condemning the present practice in designing and making locomotive fire-boxes. As our correspondent has had considerable experience with the largest locomotive type boilers in the world, his opinion is entitled to considerable weight. Many explosions of new locomotive boilers have occurred during the last few years, and in default of any unbiased or satisfactory explanation of the cause they tend to justify our correspondent's strictures on the present style of locomotive fire-box. But while much that Mr. Dean says is undoubtedly true, it must not be forgotten that the errors of an imperfect design are in many mechanical matters endured because a more perfect design involves grave difficulties in execution. Many machines that are thus a practical compromise between a theoretically perfect design and the practically possible work in actual steel and iron are unsatisfactory because the workmanship is bad and the amount of metal employed insufficient. The best remedy is not always a radical change in design. Durability and safety can often be secured rather by improvements in detail, greater care in maintenance and the use of more or better material in the parts shown to be weak by experience. The case of locomotive fire-boxes is one in point. While our correspondent rightly contends that it is impossible to calculate the strains and clearly demonstrate the actual behavior of the various parts in service, it by no means follows that such a fire-box is necessarily unsafe. The fact that on many large roads thousands of such fire-boxes have run for years with a practically complete immunity from explosion shows that fire-boxes of ordinary form can, practically speaking, be run with perfect safety. This immunity is, however, obtained by strict adherence to certain precautions. The boilers are carefully made, of good material, the dimensions of the plates, stays and braces being ample, and care being taken to avoid any liability to furrow. The boilers, when in use, are washed out at proper intervals, and periodically carefully inspected by an experienced boiler-maker, and at longer intervals are tested by hydraulic pressure. Last, not least, all repairs are executed as soon as reported, and boilers are not allowed to run with leaks or broken stays. When the precautions thus briefly outlined are carefully attended to, nothing but some unsuspected flaw in a plate or unusually rapid development of a furrow will cause an explosion.

The writer during twenty years' pretty wide experience recalls the following cases of the explosion of locomotive boilers due to defects in the fire-boxes and coming under his personal notice, having occurred on lines neighboring that on which he was then engaged: Case 1. An engine was sidetracked for repairs, a large number of stays being broken. The roundhouse foreman having a sudden demand for a large number of engines to run extra trains, got up steam in this engine and sent her out on a short trip, thinking that a few hours extra work could make no difference. A disastrous explosion, however, followed. Case 2. An old switching engine was repaired, and, being intended to work at only a moderate pressure, the repairs were carelessly executed, and, the crown bars being too short, the ends rested on the flat of the crown of the box instead of on the curve and the top of the side sheet. The roof came down on the trial trip, killing several men, the ends of the crown bars having literally punched and sheared through the crown sheet, which was old and thin. Case 3. The locomotive of a passenger train blew up just as the train was starting from a station, killing the fireman and seriously injuring the engineer and others. One of the side sheets of the fire-box was corroded or burnt away in a large patch just about level with the fire. The thinnest part was little thicker than a stout sheet of letter paper. Rupture apparently started here, and the greater part of the side sheet was thrown inwards and upwards against the crown sheet. The boiler was 17 years old, the pressure gauge was defective, the safety valve was set over 20 lbs. higher than the master mechanic had authorized, and the foreman boiler maker, who had inspected the boiler three days previously, confessed that he knew then that the fire-box was thin, but did not believe it was as thin as shown by the explosion! Case 4. An engine three years old blew up while standing at a station. A large flaw in the iron crown plate of the outside fire-box, invisible when the boiler was made, developed until the metal left was insufficient to stand the strain. This is one of the very rare cases where the inevitable explosion could not have been foreseen or guarded against by any reasonable precaution. The flaw was not visible when the plate was new and the development took place in the steam space far above the water line, a place where furrowing is rarely or never found.

Other cases might be cited, but the first three above quoted are typical of most boiler explosions. The lessons to be learnt are obvious, and it is especially palpable that immunity cannot be obtained by proclaiming that every boiler explosion is due to low water. In the great majority of explosions, a truthful verdict would read: "Owing to the gross negligence of those who constructed or maintained this boiler, it was too weak to stand a fair working pressure, and consequently exploded."

American Bridge Failures.

At the recent meeting of the British Association for the Advancement of Science Mr. Benjamin Baker read for Mr. G. H. Thomson, Bridge Engineer of the New York Central & Hudson River, a paper, part of which is reprinted in *Engineering* under the above title.

In this paper the statement is made that 251 railroad bridges failed in the United States and Canada in the 10 years, 1878–1887, "from weakness, overwork, collision, etc." These were all truss bridges, and only those accidents are included "which resulted directly from the presence of a train on a bridge." The well-known facts of the increase of weight and speed of trains, increased weight on engine drivers and greater strains brought upon bridge structures by

the use of power brakes, are discussed at some length, and the conclusion is suggested that American bridges are not designed with sufficient regard to the shocks of collisions and derailments, or with due allowance to the increased duty which they will be called on to perform. Moreover, Mr. Thomson apparently concludes that the pin connected bridge has inherent weaknesses that make it less fit than the lattice for spans of 250 ft. or less. No reports of the discussion on this paper have yet been received, but no doubt much of it will be in the way of condemnation of American bridge material and methods in general, and of the pin-connected bridge in particular.

This record of 251 bridge failures in 10 years is certainly discreditable, and every American engineer and bridge builder must regret it. That there are still in service railroad bridges as ill adapted to present conditions as were most of those which fell is also true. But to reason from those wrecked bridges to modern American practice, or to find in those 251 failures ground for general condemnation of the American system of bridge construction is absurd. It would be just as rational to conclude, as some writers did after the wretched Bussey bridge fell, that iron is an unsuitable material for railroad bridges on account of the danger of crystallization, and that only wood or stone should be used. To understand how little value can be attached to this record it need only be said that we are not even told whether or not these 251 bridges were all iron bridges, or how many of them were of wood, nor are there given any but the most general details of their design and construction. Further, in making any comparison of the number of bridge failures in America and in England, one must not forget the enormously greater number of bridges here, and the greater average length of span. In a recent paper on American railroads Mr. T. C. Clarke estimated the aggregate length of the railroad truss bridges in the United States at 1,086 miles. It would be fair to assume that those which failed were not, in length, one per cent. of the total. We have no means of knowing whether or not the bridges of foreign builders show a greater or less percentage of failures than those of American builders, and have no disposition to ignore the shortcomings of our own builders, but we cannot see that these 251 failures prove anything for or against American practice. The conditions under which American railroads have been built are known to all the world. Private enterprise has covered a continent with a vast system of railroads, all of which have been built in a country comparatively thinly settled, and many have been built on the very frontier of settlement. Under the circumstances, economy has been absolutely necessary, and it became almost a disease. Moreover, for many years the fast-growing system outran the supply of trained men, not only in the engineering departments, but in all others. It is not surprising that many bridges, defective in design, in material and in workmanship, should have been built on American roads, or that some such are still in use. The true use of such a paper as Mr. Thomson has written is to call attention to the fact that weak bridges exist; but so far as can be judged from that part of it which has appeared, it has little value as part of a general discussion of systems. Its proper office it will undoubtedly fill; but pin-connected bridges will still be built.

Uncontrolled Competitive Rates.

The decision of the Inter-state Commerce Commission in the matter of the Chicago, St. Paul & Kansas City is the most important rendered by that body since the Louisville & Nashville case. The railroad claimed exemption from the provisions of the long and short haul clause. Its local rates, it said, were reasonable; its through rates were made lower than its local ones because of the competition of the Chicago, Burlington & Northern. The through rates of that line were unreasonably low, and therefore not in conformity to the Inter-state Commerce act, which provides that rates must be "reasonable." In other words its through traffic was subject to irresponsible competition, just as much as if it were competing with a water route. This, in the view of the company, constituted a difference of circumstances and conditions, and warranted it in disregarding the short-haul principle.

The Commissioners were placed in an awkward dilemma. They knew enough about railroad management to see that the contention of the company was practically true, but if they admitted its force, they made the Inter-state Commerce law a dead letter. They solved the difficulty by taking a narrow view of their own authority under the statute. Their words are these:

"It may be quite true as respondent contends, that unless carriers are suffered to meet the competition of a rival at an important point without reducing intermediate rates, they will suffer unreasonably, perhaps destructively, in their resources. But this question is not to be decided in the interest of the carriers only; the communities which the act undertakes to protect are to be regarded also. The act has doubtless conferred upon the Commission a greater power to protect localities against the carriers than it has to protect the carriers against themselves or against each other. It was probably thought in Congress that with the liberty of action left to the carriers they would not needlessly rush to destruction. The assumption may not prove to be well founded; but nothing seems plainer than that under the law as it stands the protection of carriers against destructive rivalry, and rates that lead directly to bankruptcy, must be found chiefly in prudent management, in the cultivation of reasonable relations among themselves, in mutual forbearance, and the application of a sense of justice to their mutual dealings and in their rivalries. If they deliberately proceed to destroy each other, the law must take care that in doing so they injure as little as possible individuals and communities dependent upon them for transportation facilities."

But all this, even if granted, does not seem to us fully to cover the case. It simply makes out that the Commission does not have the power to control the reckless action of rival lines. If this be so, why does not such uncontrolled competition make a difference of circumstances and conditions? What is the difference between an uncontrolled American road and an uncontrolled Canadian road? It is at most only a difference in degree. The Commission hardly claims anything more than this. "It may, perhaps," they say, "be subject to no restraint directly applied; but many of the requirements of the act must have an important restraining influence." This is taking a rose-colored view of the matter. It is hard to see this effect of the law to-day. The clause prohibiting pools has taken away from the companies more restraints against irresponsible action than everything else which it offers as a substitute in the form of legal control.

The question whether unreasonably low rates conflict with the statute is decided by the Commission in the negative. They lay great stress on the intentions of Congress at the time when the bill was passed. They say that the idea of a minimum limitation was not in the mind of Congress, and would not have been seriously entertained. But if the Commissioners will turn to the proceedings of the Senate select Committee on Inter-state Commerce they will find, among the original questions in the circular sent out by that committee, the following: "3. The advisability of establishing a system of maximum *and minimum* rates for the transportation of inter-state commerce." They will find that it was fully discussed by a number of witnesses before the committee, and that the question of a lower limit in reasonable charges was most seriously entertained in their discussions of the subject.

Whether the Burlington & Northern has made its rates so low as to transgress any proper reasonable limit we cannot say. But if it has thus transgressed, its action is *de facto* outside of the control of the act. If the Commissioners simply say: "What can we do about it?" they only emphasize the absence of control. If they plead that there is a sort of indirect control, not visible to the naked eye, they shirk their responsibility. We congratulate Commissioner Schoonmaker on his courage in not concurring with the most doubtful part of the opinion.

The Inter-state Commerce law has owed most of its success thus far to the fact that the Commission has fairly represented conflicting interests in a complicated and disputed matter. If the board disclaimed the power to protect the railroads, it will deal the severest possible blow to its own authority. We admit the difficulty of the situation. The board is entrusted with the execution of a law containing some questionable provisions which made its application a matter of the utmost difficulty. By prescribing the short-haul principle it makes the local rates of a road depend upon its through rates. By prohibiting pools it makes the local rates of one road depend upon the uncontrolled action of another. When the Commission refuses to investigate the question whether the action of the other road is reasonable, it deprives the company of all protection in the matter. Neither the Commission nor the business interests of the country can afford to have things left in this way.

Dividends and Earnings.

An ancient writer once expressed the opinion that an ill-timed piece of virtue was a very bad thing. Somewhat the same sentiment seems to prevail among the security holders of the Chicago, Milwaukee & St. Paul There are a great many men who feel less objection to a doubtful policy than to any sudden change. As long as dividends were regularly paid, doubts as to whether they were really earned troubled comparatively few foreign stockholders. But now that the company has actually forced the situation, there are loud cries for special action.

We are not disposed to discourage any movement by which investors seek to gain fuller knowledge of their own affairs. But we cannot help thinking that they have chosen the wrong occasion for doing it. The condition of the St. Paul's traffic had been perfectly well-known for some time. The expectation of a dividend was based not so much on traffic returns as on the past policy of the company. What the directors did was to break with their past policy and conform to the facts. An investigation at this time is perhaps better than no investigation at all; an investigation at some other time would have been better still. To place a man under surveillance because he has begun to lead a virtuous life is not exactly the way to persuade others to follow his example.

But if this movement on the part of foreign holders leads to any settlement of the proper relation between dividends and earnings, it will be a good thing. At present there is no such principle. Some roads, like the New York Central, have been earning without dividing; others, like the Rock Island or the C., B. & Q., have for the time being apparently divided more than they have earned. Any such variations in practice give the directors a dangerous power, and sometimes furnish them with an almost irrepressible motive to speculate in their own stock. For though the public ought to judge of the value of a road by its earnings, it practically is influenced, in all but the most notorious cases, by the amount of its dividends.

There are two distinct views as to the principle on which dividends should be declared. One is that a road should divide all or nearly all that it earns, year by year. The other is that the directors should estimate its probable earning power for a series of years, and so arrange accounts and expenditures that the sum divided should vary as little as possible from this general rate. The former is the English practice, the latter, on the whole, the American. Each has much respectable authority in its favor, each has its own advantages and its own dangers.

Neither method affords complete immunity from fraud. Before we know what can be divided we must know the amount of net earnings, and this, of itself, gives much chance for manipulation. The gross earnings of a company are in most cases pretty easy to ascertain; but in order to know the amount of operating expenses we must know how much is to be charged to maintenance and how much to construction. If the finances of the road are managed on the English plan, maintenance charges will vary comparatively little from year to year. The policy is to make and pay for all ordinary repairs and no extraordinary ones, keeping the latter within as narrow limits as possible, and charging them to capital account when they become inevitable. Most American companies, on the other hand, if they had had a prosperous year, would make and pay for an unusually large number of improvements, sometimes charging them to maintenance account and sometimes meeting them by special appropriations for renewals. When a bad year comes they pursue the reverse policy, making as few repairs and renewals as they can; or, in the worst case, paying for them by an increase of floating debt, which they trust may be canceled when prosperity returns.

The two methods may be fairly contrasted by saying that the English involves fixed maintenance and varying dividends; the American, varying maintenance and fixed dividends.

The advantage of the former policy is that it gives less room for speculative action on the part of the directors. It is easier to estimate the doings of the present than those of the future. If each year is allowed to stand by itself, there is less excuse for mistakes of judgment.

On the other hand, a complete application of English principles to American railroad financiering would render the stocks of many of our roads wholly unsuitable for the small investor to own. English traffic varies comparatively little from year to year. That of many of our Western roads changes so rapidly that a man who depended upon their actual earnings for his income would find himself rich one year and poor the next. He might, of

course, avoid this difficulty by investing in bonds instead of stocks; but it would be highly undesirable on grounds of public policy to have the stocks themselves cease to be a stable investment. Add to this the danger that, if a road in some of our states should divide the whole of its earnings in a prosperous year, it would probably be subjected to such adverse action by the state authorities as would prevent its having any more profits to divide for several years to come.

These facts are quite enough to explain the practice which has hitherto prevailed in this country. But we are inclined to think not merely that the English method is more correct in theory, but that American railroads are likely to move in the same direction. There are several reasons for this. In the first place, as the country becomes more fully settled, variations in annual earnings become relatively less. This takes away the chief practical objection to the policy of dividing what is actually earned. Meantime the general rate of profit on investments grows less; and roads which have been arranging their accounts on a basis of a seven or eight per cent. dividend, find it increasingly difficult to do so. Sometimes they foresee the trouble in time to be able to content themselves with a moderate reduction. More often they keep up the old rat too long in the vain hope of better times. This was the case with the New York Central until a few years ago; it seems *likely* to have been the case with the St. Paul until now; and we may expect the same experience to be repeated with other Western systems in the immediate future.

The reaction against such a mistaken dividend policy is sometimes such as to aggravate the evil. The New York Central and other Vanderbilt roads have been paying the penalty of past misdeeds. Their high dividend rate tempted parallel railroad construction This diminished their earning power, and its results could only be remedied by consolidation on disadvantageous terms. The companies were thus burdened by an inflated capital account, and in striving to atone for this error they have for some years divided less than they actually earned. In the financial practice of the present day we thus see, side by side, roads which are trying to keep up an unearned dividend, as a matter of past tradition, and roads which, having giving up this attempt, are now at the opposite extreme; while each transition from one policy to the other gives rise to a dislocation of values and a flurry among investors. Such confusion cannot last forever. We believe that it will be remedied by an increased tendency on the part of our companies to divide what they have actually earned during the period in question, rather than what they have earned in the past or expect to earn in the future. The increased publicity of railroad accounts renders any other policy more difficult. The greater stability of railroad traffic which must come with the growth of the country will render this method the easier. Where it can be applied without too great fluctuations for the legitimate investor, it renders the task of railroad directors simpler, and greatly lessens, if it does not altogether remove, some of the temptations to the abuse of their power.

The Missouri, Kansas & Texas.

The application for the appointment of a receiver for the Missouri, Kansas & Texas involves some delicate questions—not so much questions of law as of fact. The road has been leased to the Missouri Pacific since 1880. That company has now failed to meet its obligations to the bondholders under the lease. Under these circumstances shall the Missouri, Kansas & Texas be given over to its own stockholders, or shall it pass into the hands of a receiver? This is the question now before the court.

The failure of a leased road to meet its fixed charges may be due to either of two causes. It may be that the actual earning power of the road is insufficient for its obligations; or it may be that the lessee has so mismanaged the property that injustice was done to its real earning power. In the former case, a receiver should unquestionably be appointed, this being, if the receiver is honest, the best method of keeping the property in good working order while conflicting claims are adjusted. But if mismanagement on the part of the lessee was the cause of the trouble, it is on the whole prudent as well as just to give the stockholders control of the property.

In the present instance both causes have been at work side by side, and there is room for honest difference of opinion as to which has had the chief influence. At the same time, the facts presented by the investigating committee of the directors of the M., K. & T. seem to us to show the necessity of appointing a receiver. It is stated in the telegrams from St. Louis that Mr. Sterne has presented figures pointing to a different conclusion; but in the absence of detailed information we find it hard to believe this.

In 1880 the Missouri, Kansas & Texas Company leased its road, then amounting to somewhat less than 900 miles, to the Missouri Pacific. The stockholders were to receive as rental the net earnings after paying (1) operating expenses, taxes, maintenance, repairs and necessary betterments, (2) organization expenses, and (3) interest on funded debt. At subsequent periods, additional lines were built by the issue of new bonds, under arrangements which had been made previous to the lease; while by exchange of stock, the International & Great Northern was practically incorporated in the Missouri, Kansas & Texas, making a total of some 2,500 miles.

In the year prior to the lease, the available net revenue of the company was $1,545,000, while the fixed charges contemplated in the plan of reorganization amounted to $1,849,000—a net deficit of over $300,000. Only by improvements in general traffic conditions could this deficit be met. The lease was placed, so to speak, on a speculative basis at the very outset. After two years of doubt the speculative arrangement seemed to be finally justified In 1883, the net revenue had increased to 3,343,000, while fixed charges under the lease were only $2,971,000. During the three years, 1883 to 1885 inclusive, the surplus averaged about $370,000.

But this prosperity was of short duration. Gross revenue soon fell off, while operating expenses showed a tendency to increase. The Missouri Pacific, in fact, managed the property in disregard of the interests of the lessor. It diverted traffic which naturally belonged to the M., K. & T. on to other parts of the system, taking advantage of an award of arbitrators, before whom, it is said, the M., K. & T. representatives had no chance to present their case. Meantime it appeared that the prosperity of past years had been apparent rather than real. Net earnings had been unfairly swelled by short-sighted reductions in operating expense. In plain English, the authorities had not made the necessary repairs, and any temporary gain in that way was bound to cause more than corresponding loss in the future. The financial condition of the newly acquired lines, like the International & Great Northern, was still worse than that of the original system. The deficit of the whole since the beginning of 1886 is more than $2,500,000.

It is perfectly plain that the property was not rightly managed. The stockholders have just ground to complain of their treatment by the Missouri Pacific authorities. But it is by no means clear that they have a right to protest against the appointment of a receiver, or that good management would have enabled the road to meet all its obligations. The evidence is in the other direction. The facts with regard to maintenance expenses go to show that the apparent temporary surplus was largely, if not wholly, fictitious. In other words, the speculative basis on which the original lease was established proved an unsound one; and the Missouri Pacific, by its action, simply postponed the appearance of the trouble and aggravated its seriousness. Under these circumstances a receivership seems inevitable. The important thing for the stockholders is, that the receiver should not be named in the interest of the Missouri Pacific. The facts stated do not warrant the stockholders in claiming to run the line for themselves, but they do warrant them in protesting against further interference by the lessee in the affairs of the company.

Annual Reports.

Northern Pacific.—General results of operations have been as follows:

	1886-7.	1887-8.
Earnings—Freight	$8,730,547	$10,426,244
Passenger	3,269,703	4,577,898
Total, incl. misc.	$12,789,448	$15,846,327
Expenses—Conducting transp.	$1,960,555	$2,552,452
Motive power	2,205,679	3,044,847
Maintenance of cars	763,745	822,139
Maintenance of roads and structures	1,597,523	2,239,542
General expenses	375,112	366,614
Total	$6,904,616	$9,025,596
Net earnings (deducting taxes)	$5,616,4 8	$6,579,443
Total revenue	6 090,795	7,127,980
Fixed charges	6,025,087	6,609.295
Surplus	65,708	518,685

The capital account shows but slight changes, and these are really less than they appear. It may be condensed as follows:

Stock, common	$49,000,000
" preferred	37,488,618
Funded debt	80,334,000
Guaranteed bonds	18,768,900
Accumulations	6,196,578
Current debt	10,721,235
	$202,508.431

The average mileage operated increased from 2,876 in the year ending June 30, 1887, to 3,219 in the year ending June 30, 1888.

The increase of nearly half a million dollars in the year's surplus is gratifying, and not altogether anticipated. It is satisfactory to see from the report of operations that it is the result of sound and legitimate growth of business. Expenses have been by no means restricted; maintenance charges form over 14 per cent. of the total this year, against less than 12½ per cent. the year previous. Volume of traffic increased largely, as will be seen from the following figures:

Tons of freight moved:	Tons.	Tons one mile.
1887	2,128,166	537,180,940
1888	2,597,897	704,772,506
Increase	469,731	167,591,566
Number of passengers carried:	Number.	Number one mile.
1887	979,505	111,958,786
1888	1,343,737	159,483,895
Increase	364,232	47,525,109

This increase was obtained with a comparatively small expansion of train service and train service charges.

Miles run by passenger and freight trains:

	1887.	1888.	Increase.
Passenger trains	2,308,747	3,281,380	972,633
Freight trains	4,416,944	5,427,226	1,010,282
Totals	6,725,691	8,708,606	1,982,915

Cost of operation per train mile (excluding taxes):

	1887.	1888.	Inc.	Dec.
Passenger	$0.956	$0.916	.. ..	$0.040
Freight	1.063	1.109	$0.046	... ..
Passenger and freight	1.027	1.037	0.009	.....

In other words, the average freight train load has increased from about 120 tons to 130, while the passenger train load has also increased slightly, the cost of operation per train mile remaining nearly the same. Under these circumstances it was possible for the average ton-mile rate to fall, as it did, from 1.626 cents to 1.446 cents without serious loss of economy to offset the increased volume of traffic. The improvement in freight economy was even greater than these figures indicate; for while in the previous years the ton-mileage west-bound was much greater than the east-bound; in the current year the two were almost exactly equal—a great source of economy in utilizing car space. The comparison of east and west-bound passenger business shows some curious changes. There was a diminution from 105 miles to 91 in the average passenger journey eastward; and at the same time an increase from 122 miles to 145 in the average journey westbound. We are somewhat at a loss how to account for this difference.

August Accidents.

Our record of train accidents in August, given in this number, includes 88 collisions, 121 derailments and 13 other accidents; a total of 222 accidents, in which 56 persons were killed and 202 injured.

These accidents are classified as follows:

COLLISIONS:		
Rear	43	
Butting	30	
Crossing and other	15	
		— 88
DERAILMENTS:		
Broken rail	9	
Loose or spread rail	4	
Broken bridge	5	
Defective switch	7	
Broken frog	1	
Broken wheel	6	
Broken axle	7	
Broken truck	5	
Boiler explosion	1	
Misplaced switch	7	
Runaway train	1	
Bad loading	2	
Bad switching	4	
Open draw	1	
Cattle on track	6	
Landslide	6	
Washout	4	
Accidental obstruction	3	
Malicious obstruction	5	
Purposely misplaced switch	3	
Unexplained	34	
		—121
OTHER ACCIDENTS:		
Cylinder explosion	2	
Broken parallel-rod	5	
Broken crank-pin	1	
Broken truck	1	
Miscellaneous	4	
		— 13
Total number of accidents		222

The causes of collisions where given were as follows:

	Rear.	Butting.	Crossing.	Total.
Trains breaking in two	5	..	1	6
Misplaced switch	7	3	..	10
Failure to give or observe signal	3	3	2	8
Mistake in giving or understanding orders	..	2	..	2
Miscellaneous	9	3	3	15
Unexplained	19	19	9	47
Total	43	30	15	88

A general classification shows:

	Collisions.	Derailments.	Other.	Total.	P. c.
Defects of road	..	26	..	26	12
Defects of equipment	7	19	12	38	17
Negligence in operating	32	15	..	47	21
Unforeseen obstructions	2	27	1	30	13
Unexplained	47	34	..	81	37
Total	88	121	13	222	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other.	Total.	P.c.
Passenger	31	37	9	77	26
Freight and other	127	84	4	215	74
Total	158	121	13	292	100

The casualties may be divided as follows:

	Collisions.	Derailments.	Other.	Total.	P. c.
KILLED:					
Employés	20	23	..	43	76
Passengers	1	3	..	4	7
Others	2	7	..	9	17
Total	23	33	..	56	100
INJURED:					
Employés	42	55	3	100	49
Passengers	32	58	..	90	44
Others	3	9	..	12	7
Total	77	122	3	202	100

Thirty-four accidents caused the death of one or more persons, and 50 caused injury but not death, leaving 138 (62 per cent. of the whole) which caused no personal injury worthy of record.

The comparison with August, 1887, shows:

	1888.	1887.
Rear collisions	43	30
Butting collisions	30	34
Crossing collisions	15	1
Derailments	121	64
Other accidents	13	8
Total accidents	222	137
Employés killed	43	45
Others killed	13	84
Employés injured	100	89
Others injured	102	234
Pass. trains involved	77	51
Average per day:		
Accidents	7.16	4.42
Killed	1.77	4.16
Injured	6.54	10.42
Average per accident:		
Killed	0.248	0.941
Injured	0.914	2.358

The number of accidents is the largest recorded in any month since January, 1881. The list for that month, however, apparently includes a larger proportion of slight accidents, such as comparatively harmless derailments from snow. The black record of August, 1887, includes the Chatsworth disaster, but the present showing is bad enough in comparison, even after deducting the casualties at that accident.

One of the worst accidents of the month was that at Boonville, Mo., on the 31st, where four section men at work beside the track were killed or badly maimed by a derailed train. The most startling accidents were the collision and derailment of two fast passenger trains on the Erie within about 24 hours of each other. The circumstances attending these have already been detailed in these columns. The misplacing of the switch in the collision near Corning is saddled by the coroner's jury upon a brakeman of the freight train. The running of an engine into the Schuylkill River at Philadelphia is classed among the accidents caused by negligence, but it appears that it was not the draw-tender's fault; the coroner's jury decides that an adequate danger signal was exhibited. A derailment from a misplaced switch at Niagara Falls resulted, not from a peculiar cause, but from one peculiarly reported; the reporter discovered that the brakeman of a previous train left the switch wrong, "in order to avoid getting left." Trainmen do various reckless things to avoid getting left, but they do not generally mean to have it told of. If all the rear collisions that occur from this cause were truthfully reported we should probably have a longer list than we have this month, and every other month.

Two big fires caused by collisions of oil cars are reported this month. The comparative infrequency of this sort of disaster on any one road or division makes it all the more necessary to repeatedly instruct freight and yard men concerning the dangers incident to oil transportation. At Chicago a large grain elevator escaped the flames only because it was sheathed with iron. A bad collision on a bridge at Trenton, N. J., resulted apparently from the engineer's yielding himself too readily to the force of habit. He had 25 passenger cars, without a continuous brake, and apparently ran through an important yard at the same rate of speed that he was accustomed to use with the train under his complete control; and he and a half dozen others had to jump for their lives.

Some other notable accidents were: Mapleton, Pa., on the 7th, where "bad switching" apparently was responsible; near La Grande, Ore., on the 27th, where a passenger train with a broken wheel and a useless power-brake was "completely smashed up" and yet no one was hurt; and at Howard, O., on the 31st, where a "mistake in reading orders" badly injured two men. Three train accidents in August were caused by trees blown across the track. Of the defective bridges, two at least were weakened by floods.

The following code of work shop instructions were used by the well-known mechanical writer, "Chordal" (James W. See), when acting as works manager. It will be seen that the rules relate principally to the interpretation of the drawings. While the rules as a whole may be commended, exception must certainly be taken to that sanctioning and even enforcing the general use of the vee thread, which is a mechanical relic of barbarism, and should never find a place in the work of a mechanical engineer possessed of self-respect and a knowledge of his business. These rules have been in use for some time, and possibly the author has in his present practice adopted a better form of thread as standard. The rules are given in the *American Machinist* as follows:

To Pattern Makers.—Measure and make your allowance for shrinkage and draft. Holes with no size given are to be cored to size. Do not measure where figures are given. Always add for finish when figures are given. Add for finish when you find the word "polish." Where two views are shown, the size is generally marked in but one place; the same with holes of the same character; look out for this. Don't forget the fillets and rounds on all round work. Mark all patterns, core-boxes and pieces with a symbol and number. Two ciphers before a number mean brass. If one pattern makes two pieces with additions, put both numbers on the piece used for the two.

To Blacksmiths.—Work to the figures and allow for finish, except where you find the word "rough."

To Machinists.—Do not finish where there are no figures, unless you find the word "finish" or "polish," or have special instructions. Where nuts and boltheads come down on rough castings, you will counterbore the surface so as to allow them to come down square. Countersink the first thread out of all tapped holes, not with a drill but with a hand countersink. Touch all bolt holes lightly with the same tool. Chamfer the first thread of all screws before fitting them in a hole. Leave no ragged corners. Where a corner is formed by a rough surface and a finished one, round the corner nicely and boldly. A hole marked "tap" is to have a thread in it, either tapped or chased. All screws are right hand V unless otherwise mentioned. All keys set in shafts are to be in depth one quarter their width unless otherwise stated. Don't polish any work not marked polish, except on special instructions. Where a hole to be drilled is shown and no distances are given, it is either to be scribed from some other piece, or is to be in the centre of a boss. Make all fits by varying the size of the internal piece. Let all holes be standard.

The yellow fever continues to spread throughout the South, though dispatches are contradictory, and it seems clear that there is much caution and rigid enforcement of quarantine at points where the danger is perhaps quite remote. Passenger traffic has been considerably disturbed in various parts of Tennessee, Georgia, Alabama and Mississippi, and in the two last named states whole roads seem to be at a complete standstill. Notices of refusal to accept freight for large districts have been numerous. Various cities have established a quarantine and prevented railroad trains from passing through their limits, and the discontinuance of passenger trains seems to be largely owing, to similar action by numerous small towns. In many places citizens have taken the law into their own hands, intercepting travel by "shotgun quarantine." A dispatch from New Orleans of Monday stated that all local trains had been abandoned on the Illinois Central, and that all trains had been taken off the New Orleans & Northeastern, on account of the action of the quarantine authorities at Meridian, Miss. It was reported that the Texas & Pacific would apply to the United States Courts for an order forbidding the health authorities of Shreveport, La., to interfere with trains. Officers of the Southern roads in New York City speak hopefully, expressing the belief that not enough traffic will be lost to make a serious shrinkage in earnings. There will probably soon be a frost sufficient to destroy contagion.

The time of the last day's race between London and Edinburgh is given as follows for the East Coast route: Time actually in motion, 407¼ min.; time standing at five stoppages, 39½ min.; distance, 392½ miles; average speed while in motion, 57.8 miles per hour; average speed including stops, 52.7 miles per hour; maximum speed, 4 miles run in 3 min. 8¾ sec., equal to 76.3 miles per hour. On this occasion the train arrived 33¼ min. ahead of schedule time. It is claimed that on another day the time actually in motion was 398 min. for 392½ miles, one run of 105¼ miles being made in 106 minutes. The train, excluding engine and tender, is stated to have weighed about 270,000 lbs. The statement that the Worsdell compound engines were beaten in speed by ordinary locomotives is authoratively contradicted, and it is stated "that the shortest time taken by the non-compound engine from Newcastle to Edinburgh, a distance of 125 miles, was 131 min., and by the compound 128 min.; same weight of train, and under similar circumstances."

A Western paper states that a special train over the Montana Central (an extension of the Manitoba system in Montana) made the remarkable time of 72 miles in one hour over the new line. The party consisted of President Hill, of the Manitoba road, President Broadwater and General Manager Shelby, of the Central line, and Samuel Thorne, a New York capitalist. When this remarkable time was made the party was at breakfast, but suffered no inconvenience.

There is no reliable record of any locomotive ever having covered 72 miles within one hour, and it appears unlikely that this speed was attained on a new road, though that rate of speed might very possibly be reached for a short distance on a down grade. The major portion of the Montana extension of the Manitoba has excellent grades and few curves.

NEW PUBLICATIONS.

The railroad paper in the October number of *Scribner's Magazine* is "The Railroad in its Business Relations," by Prof. A. T. Hadley. The influences which led to the present system of ownership and management of railroads are briefly pointed out, and the work of Thomson, Scott, Vanderbilt and Garrett in organizing the great systems which have grown up since the war is mentioned. Some of the methods by which railroad properties are manipulated for or against the interests of the owners or of the community are explained, and the opportunities and responsibilities which surround the high officers are also considered in a few paragraphs. The good and bad effects of consolidation, the theories which govern making rates, the great question of government control, and the public uses of pools are all discussed somewhat. Of course in such a review of the relations of the railroads to each other and to the public, there must be some mention of the legislation in various states. The whole paper is written with the orderly method, and in the clear and simple style which one always finds in the work of this author, and it will not only serve the publishers' purpose of entertaining the great audience to which it goes, but will help to spread correct ideas of the duties of the railroads toward the public, and (what is even more important) of the duties of the public toward the railroads. The paper is illustrated by portraits, some of them very fine, of Stephenson, Vanderbilt, Scott, Garrett, Edgar Thomson, Fink, Adams and Judge Cooley.

TRADE CATALOGUES.

Civil Engineers' and Surveyors' Instruments. W. & L. E. Gurley, Troy, N. Y. 1888.

This catalogue calls special attention to a new postilon for the verniers on the limbs of transits. They are placed at an angle of 30 deg. with the telescope, so that they can be read at once without any movement by the transit man. This is such an obvious advantage for railroad work that it seems strange it has not been adopted before, particularly as the position chosen by the Messrs. Gurley does not in the least interfere with the use of the transit in any case where such precision is demanded as to require the reading of both verniers.

Among the lesser improvements are a new clamp by which the limb is securely fastened without any possibility of springing the plate, and a new tangent or slow motion screw with an opposing spring to take up lost motion, which is applicable to the limb and telescope of transits and to the leveling heads of transits and levels.

Messrs. Gurley have brought out what they think is the first really practical hand level with telescope that has yet been made, combining better sight as well as considerable magnifying power. Two styles are shown, one monocular and the other binocular. Of the latter they say that it gives a clearer view of an object than is possible with a single tube, there being no light lost by the interference of the prism and level tube. A binocular hand level will present strongly to the engineer using it the advantages of having stadia wires in the clear tube. To accomplish this something besides the ordinary opera glass must be used, as the only focus to opera glasses is behind the eye piece. We think it was Sir William Logan who fitted a prismatic compass to a telescope containing stadia wires, and with the aid of it and a rod determined the courses of many miles of Canadian streams.

THE SCRAP HEAP.

A Terrible Hand-Car Ride.

A party of 14 workmen and a woman, the wife of Foreman Larney, of the Delaware, Lackawanna & Western, were descending plane No. 4 at Plymouth, Pa., one morning last week seated upon a hand-car, when the brake of the car was suddenly broken. It then went down the plane with tremendous rapidity. James Miller fell upon the rails and the car struck him and was thrown from the track. Miller was fatally injured, his head being crushed and both legs severed from the trunk. Only two of those on the car escaped injury. Mrs. Larney sustained a fracture of the skull and will die. Ten others were serious injured.

Y. M. C. A. Building at New Durham.

The new railroad men's building of the West Shore road at New Durham, the first building of its kind in the state of New Jersey, was opened on the evening of Sept. 19. It is a hand-some two-story structure, with reading and amusement rooms, and bathing facilities. Mr. Cornelius Vanderbilt and other officers of the New York Central, West Shore and New York, Ontario & Western roads contributed to the funds for erecting the building. General Superintendent C. W. Bradley, of the West Shore, who is chairman of the branch at the Weehawken depot, had charge of the opening exercises.

Strikes.

A dispatch from Des Moines, Ia., Sept. 20, stated that the wages of engineers, firemen, brakemen and conductors on the Chicago, Burlington & Quincy had been reduced from $5 to $15 per month. The officers of the road say that there is no truth in the dispatch, though their explanations seem to indicate that there has been a revision of wages of some sort. A dispath from Kansas City states that the engineers of the Burlington system there are expecting a reduction

A dispatch from Ashland, Wis., Sept. 23, states that the switchmen of the Wisconsin Central there, who struck for $2.25 per day, and were discharged, were congregating about the yards and attempting to prevent new men from working. The Mayor was called upon by the road for extra police.

Five crews [another account says 40 crews] of freight trainmen on the Chicago division of the Illinois Central left their work on Wednesday of last week because they were not paid for overtime, which, it is said, they wish to have allowed at the rate of 35 cents an hour. During the busy season, when freight traffic is heavy, trains are detained a long time before they can enter the Chicago yard. Dispatches state that a petition concerning this point had been sent to headquarters ten days before and that no response to it was made; but on the men quitting work the company at once agreed to put on switching crews to take the trains into the yard, thereby relieving the road crews at Thirty-ninth street in fair time.

Coal on the Pacific Coast.

Discoveries and developments of coal are continually being made throughout the Northwest, according to the *Portland Oregonian*. One of the most promising is the Turtle River mine in Washington Territory, 1½ miles from the Northern Pacific Railroad and 2 miles from the Cowlitz, which offers during 10 months of the year a steamboat navigation from opposite the mine 20 miles to the mouth of the river. The company have two veins of cannel coal, producing about 3,500 tons of coal to the acre. Analysis shows: Fixed carbon, 32.25; combustible gases, 52.21; ash, 7.54; moisture, 8.00. It is said, after tests on the Portland & Willamette Valley Railroad, to be a very good locomotive coal.

The Wellington coal, mined on Vancouver's Island, and almost directly opposite Vancouver, seems to be the best coal so far discovered on the coast. Nearly half a million tons were exported from Vancouver's Island last year, and the mine is said to be practically inexhaustible. Tests by the War Department of this country showed that for steam raising it took 1,800 pounds of the Vancouver Island coal to 2,400 pounds of Seattle and 2,600 of either Coos Bay or Monte Diabolo (California) coal to accomplish the same work. British Columbia also has mines of good coal on Queen Charlotte Island, north of Vancouver's Island, on the main land, and near to Fraser River.

Employe's Reputations.

Judge White, at Pittsburgh, this week, handed down an opinion in the suits of John C. Henny and S. M. Kennedy against the Pittsburgh & Lake Erie Railroad. The plaintiffs were among the employés of the road discharged some time ago, and brought suit for $50,000 damages, claiming they were dismissed under a cloud, and that their reputations were injured to that amount. Judge White's decision was in favor of defendant. He held that the discharge of plaintiffs in the manner set forth by them furnished no ground for action, as an employer has a right to discharge an employé with or without cause.

Stealing.

The Wagner Palace Car Co. has discharged a clerk in the New York office and several conductors for defrauding the company. Money for seats sold was pocketed by the train men and the checks were sent in unpunched to the clerk who reissued them.

Train Accidents.

(*Continued from page 637.*)

boose and 3 cars of freight train derailed and wrecked; conductor injured.

8th, on New York Central & Hudson River, near Charlotte, N. Y., several cars of passenger train derailed at the crossing of the Rome, Watertown & Ogdensburg.

9th, on Wabash road, near Springfield, Ill., passenger train derailed, doing some damage and fatally injuring a man riding on the front end of a baggage car.

10th, on New York, New Haven & Hartford, near Meriden, Conn., engine and tender of freight derailed.

11th, on Lake Erie & Western, at Lima, O., freight train derailed at a street crossing, damaging 4 cars.

12th, on Louisville & Nashville, near Adjers Station, Ala., several cars of freight train derailed.

15th, on New York, Pennsylvania & Ohio, at Saegertown, Pa., freight train derailed.

19th, on West Shore, near West Camp, N. Y., 2 cars of freight train derailed.

20th, on Houston, East & West Texas, near Houston, Tex., locomotive of passenger train derailed and overturned; 3 trainmen injured.

22d, on Northern Pacific, near Heron, Mont., freight train derailed and engine and several cars wrecked.

23d, on New York, Lake Erie & Western, in Jersey City, N. J., 4 cars of freight train derailed and wrecked.

23d, on Chicago, Milwaukee & St. Paul, at Meridian, Wis., construction train derailed, wrecking engine and 5 cars.

24th, on Ohio River road, near Wheeling, W. Va., construction train derailed and thrown into the ditch, injuring 8 laborers.

25th, on Gulf, Colorado & Santa Fe, near Dallas, Tex., freight train derailed.

25th, on Pennsylvania, near Osceola, Pa., tender of engine of passenger train derailed.

25th, on New York Central and Hudson River, near Charlotte, N. Y., 2 cars of passenger train derailed.

27th, on the Baltimore & Potomac, in Washington, D. C., a car in a freight train was derailed near the Long Bridge, over the Potomac River. The brakeman was unable to attract the attention of the engineer, and the derailed car ran across a portion of the bridge on the ties, doing considerable damage to the truss also. The car finally dragged off the one next behind it, and on reaching "The Flats" both rolled down the embankment.

27th, on the Cincinnati, New Orleans & Texas Pacific, near Rathburn, Tex., empty engine derailed while running at high speed.

27th, on Richmond & Danville, at Bell Junction, Ga., freight train derailed and several cars thrown into the ditch.

27th, on Philadelphia & Reading, at Mill Creek Junction, Pa., engine of a switching freight train derailed and thrown in front of an approaching passenger train, which ran into it. Both engines, one coach and several coal cars were damaged.

27th, on Texas & Pacific, near Paris, Tex., rear car of passenger train derailed and overturned, injuring 1 trainman and 9 passengers.

28th, on Bellaire, Zanesville & Cincinnati, near Bellaire, O., mixed train derailed; 5 cars went over a bank.

29th, on Pennsylvania road, at West Palmyra, N. J., car in a freight train derailed.

30th, on Columbus & Western, near Camphill, Ga., freight train derailed, wrecking 8 cars.

30th, on Gulf, Colorado & Santa Fe, near Cameron, Tex., freight train derailed.

30th, on Cincinnati, Hamilton & Dayton, in Lima, O., engine of switching freight train derailed.

30th, on Marietta & North Georgia, at Nelson, Ga., construction train derailed.

31st, on Central Iowa, at Hampton, Ia., 3 cars of a circus train derailed.

OTHER ACCIDENTS.

2d, on Pennsylvania, near Perkiomen Station, Pa., air brake connections of a passenger train were stripped off by a portion of a truck dropped by a preceding train.

2d, on New York Central & Hudson River, near Gratwick, N. Y., engine of passenger train broke a connecting rod; the loose end demolished one side of the cab, injuring the engineer.

3d, on New York, Lake Erie & Western, near Tonawanda, N. Y., engine of passenger train broke a parallel rod, the flying pieces of which demolished the cab and tore a large hole in the boiler. Engineer hurt.

8th, on New York, New Haven & Hartford, at Rye, N. Y., engine of newspaper train broke a parallel rod.

11th, on Burlington & Missouri River, near York, Neb., engine of passenger train broke an eccentric rod, the loose end of which tore a hole in the boiler.

13th, on Boston & Albany, near Becket, Mass., engine of passenger train broke a piston rod.

14th, on Burlington & Missouri River, at Wayne, Kan., engine of passenger train starting from the station broke a connecting rod, demolishing one side of the cab. The fireman was hurled out of the cab, but received only slight injuries.

18th, on Burlington & Missouri River, near Crete, Neb., engine of passenger train blew out a cylinder head.

24th, on New York Central & Hudson River, at Penfield, N. Y., forward truck of engine of freight train broke down.

27th, on Philadelphia & Reading, at Mill Creek Junction, Pa., passenger train, ran into an engine which had just been thrown afoul of its road from an adjoining track. Both engines and several cars damaged.

29th, night, on Chicago & Northwestern, near McHenry, Ill., engine of passenger train broke both parallel rods, totally demolishing the cab.

30th, on the Connecticut River road, at Greenfield, Mass., engine of passenger train blew out cylinder head.

31st, on Louisville & Nashville, near Franklin, Ky., a crank-pin on engine of freight train broke, stripping one side of it and knocking out the cylinder head.

A summary will be found in another column.

TECHNICAL.

Locomotive Building.

The New York, Pennsylvania & Ohio has now received the last of the 10 consolidation locomotives which the Brooks Locomotive Works have built for that road. The locomotives weigh 67 tons, the drivers are 50 in. diameter and the cylinders are 20 × 24 in. They are also fitted with straight stacks and extension fronts.

The New York, New Haven & Hartford has just put in service a new Mogul locomotive, built at its New Haven shops, under the supervision of J. Henney, Jr., Superintendent of Motive Power.

The Louisville & Nashville has just completed a consolidation locomotive at the shops in Louisville.

The Atlanta & Florida has just received the first of the locomotives recently ordered.

The Cooke Locomotive Works this week sent west two locomotives for the Southern Pacific. The company is building 25 locomotives for this road.

The Rhode Island Locomotive Works has recently delivered 11 ten-wheeled locomotives to the Chicago, Milwaukee & St. Paul, and have four more to build to complete the order.

The Lake Shore & Michigan Southern has equipped one of its old locomotives with a straight stack and extension front and also puchased two new locomotives with these improvements as an experiment.

Car Notes.

The Northwestern Equipment Co. (for the Northern Pacific Railroad) has let contracts for 21 passenger cars to the Pullman Car Co.; 400 box cars to the Barney & Smith Manufacturing Co., of Dayton, O.; 100 box cars and 50 furniture cars to the Lafayette Car Works, of Lafayette, Ind.

The Harrisburg Car Manufacturing Co., of Harrisburg, Pa., has an order for 100 tank cars for the Standard Oil Co.

The Battle Creek & Bay City Railroad has ordered six passenger coaches from the Ohio Falls Car Co., of Jeffersonville, Ind.

The Delaware, Lackawanna & Western has let contracts for 300 box cars to the Jackson & Woodin Mfg. Co., of Berwick, Pa.

The Western New York & Pennsylvania has contracted for 1,000 gondola cars, divided equally between the Buffalo Car Mfg. Co. and the Terre Haute Mfg. Co.

Twenty new box cars have just been completed at the Louisville shops of the Louisville & Nashville for the Birmingham Mineral road.

The Canadian Pacific received this week another lot of the box cars which Messrs. Harris & Co., St. John, N. B., are building for the road.

The Michigan Car Co. is building a large number of 50,000-lb. freight cars for the Toledo, St. Louis & Kansas City road, and is completing them at the rate of six a day. The road is also having a large number of furniture cars built.

The Seattle, Lake Shore & Eastern has just received from the Peninsular Car Co., of Detroit, 20 new box cars and 30 new platform cars. They are equipped with the Westinghouse air brake.

The Bellingham Bay & British Columbia road has just received 30 platform cars and two locomotives at Whatcom, Wash. Ter.

The New York, Lake Erie & Western has just completed 70 box cars and three baggage cars at the Buffalo shops. The company is now building 40 flat cars, 34 ft. long at the same shops.

The East Hartford, Conn., shops of the New York & New England started up last week on a 10-hour schedule. The company is now constructing 1,600 freight cars at these shops.

The Union Pacific has just received 12 more of the emigrant sleepers which are being built for that road.

The New York & New England has recently put in service five new passenger cars on the New York and Boston trains. The cars are fitted with the Brunswick wheels and the Hale & Kilbourne seats.

The Jackson & Sharp Co., of Wilmington, Del., has recently delivered to the Allegheny Valley two Pennsylvania standard passenger cars. The company has also recently completed passenger and combination cars for the Rome & Decatur, Sheffield & Birmingham, and Carolina, Cumberland Gap & Chicago roads, and is now engaged in boxing a large shipment of cars for South America.

The Indianapolis Car Mfg. Co. last week delivered the first 1,000 cars of the 2,000 being built for the Atchison, Topeka & Santa Fe.

The Richmond & Danville will soon place in service 500 box cars, equipped with air brakes and Janney couplers.

The Fall Brook Coal Co. has just finished a new President's car. It is very completely arranged, and contains reading, smoking, state and dining rooms, besides a kitchen and pantry. It has six wheeled trucks, and is heated by the Martin system.

Bridge Notes.

The contract for building the bridges on the first 25 mile section, from Red Wing, of the Duluth, Red Wing & Southern, have been let to W. H. H. Spofford, of Winona, Minn.

The Cincinnati Southern asks proposals for erecting the steel superstructure for the bridge over Gest street, Cincinnati.

J. W. Hopkins, City Engineer, Paducah, Ky., will receive proposals until Oct. 15 for building an iron bridge across Island Creek. It is to have two 50 ft. spans and one 200-ft. span.

It is stated that the city of Augusta, Ga., will build a new bridge across the Savannah River to replace the one destroyed by the recent flood, the cost to be about $100,000.

An iron bridge is to be built over Great Brook, near Bates' Mill, at Langdon, N. H.

A stone bridge is to be built over Piper's Brook, at Newington, Conn. August Budde, of Hartford, Conn., is the contractor.

The San Bernardino, Cal., Supervisors ask for bids for a bridge at Auburndale, across the Santa Ana River.

Proposals are wanted by the Commissioners until Oct. 3 for the erection of a bridge over Camp Creek. Address John T. Cooper, Atlanta, Ga.

It is reported that several bridges will be built at Wheeling, W. Va. Address Charles C. Woods, County Clerk.

Several bridges will be constructed at Omaha, Neb. Details will be furnished by County Clerk M. D. Roche.

The contract for four Pratt truss bridges, aggregating 465 ft. in length, for the St. Paul & Duluth has been awarded to the Detroit Bridge and Iron Works.

An iron bridge is to be built over the Rock River, at Watertown, Wis.

Five bids for building the superstructure of the Seneca street bridge, Cleveland, Ohio, were received by the commissioners. The bidders were required to furnish figures for the 215 tons of iron and 35,000 ft. of lumber required. The bid of the Variety Iron Works was the lowest, the price for the iron being $74.50 per ton and for lumber $30 per 1,000 ft. The totals are as follows: Variety Iron Works, $17,068; King Iron Bridge & Mfg. Co., $21,608; Detroit Bridge & Iron Works, $23,730; Pittsburgh Bridge Co., $26,790; Shiffler Bridge Works, Pittsburgh, $27,053. The bids of the last two companies were informal and were not considered. The total cost of the bridge will be $70,000.

The Southern Iron Works, of Avondale, Ala., have contracted to build six new iron bridges in Jefferson County, Ala., by Jan. 1 next. One of the largest of the bridges will span Village Creek.

Manufacturing and Business.

The Industrial Works, of Bay City, Mich., is just completing the construction of a pile driver for the Denver & Rio Grande, of a design for special work, and which will have an extension heretofore unequaled. A powerful wrecking crane, also of special design, for the New York, Lake Erie & Western, is just approaching completion in the shops. It is built entirely of iron and steel.

The Harlan & Hollingsworth Co. have just made a contract with the Central of New Jersey Railroad Co. for the building of a passenger steamboat to ply between New York and Sandy Hook. The craft will be similar to the Monmouth.

Gould & Eberhardt, of Newark, N. J., have recently made shipments of machine tools to Buenos Ayres, Mexico and Canada, and have also received the order for the eleventh drill from one party using the Eberhardt drill presses.

It is stated that the United States Rolling Stock Co. have placed an order for bolt and nut machinery, amounting to nearly $20,000, with the National Machinery Co., of Tiffin, O., through Geo. Place, of New York.

The Memphis & Charleston will begin work at once on new shops at Sheffield, Ala. The shops will probably cost about $300,000, and will consist of a machine shop 100 × 200 ft.; blacksmith shop, 90 × 100 ft.; paint shop, 40 × 100 ft.; car shop, 90 × 100 ft.; copper and tin shop, 90 × 100 ft., and engine and boiler room, 40 × 100 ft.

Struthers, Wells & Co., of Warren, O., have engaged in the building of narrow-gauge locomotives at their foundry and machine shops. Locomotives for logging roads will be made a specialty. The inventor, W. L. Sykes, of Benzinger, Pa., has patented certain improvements that are said to cheapen the cost of construction materially.

The Greenleaf Turntable Mfg. Co., of Indianapolis, will build several crucible cast-iron turntables for the Canadian Pacific.

The Indianapolis Frog & Switch Co., has elected as President and General Manager J. E. McGettigan; Secretary and Treasurer, C. H. Bosworth. The company will make a specialty of manufacturing the Perry patent frog and crossing inventions of T. H. Perry, engineer of maintenance of way on the Lake Erie & Western. The company expect to be in operation in 30 days. The capital stock of the company is now $40,000.

The Reliance Gauge Co., of Cleveland, O., recently received through the Reading Iron Works, of Philadelphia, another order from the Pencoyd Iron Works, of Pencoyd, Pa., for eight of their safety water columns. This is the fourth order from the Pencoyd Iron Works.

The American Lighting Co., of which Mr. A. Gunnison is President, has acquired the title to all the devices for car lighting by means of compressed gas, recently owned by the Foster Lighting Co. The office will remain at 120 Broadway, New York.

The Standard Metal Tie & Construction Co., of 155 Broadway, New York, is having several large presses constructed at the E. W. Bliss Co.'s works, Brooklyn, for the manufacture of their ties. These will be finished about Nov. 1. Orders for a number of trial lots of the metallic tie have already been received.

The Martin Anti-fire Car Heater Co.'s works at Dunkirk, N. Y., have proven inadequate to the immense business done there, and large additions have been made to the building.

The Fall Brook Coal Co. has just received at the Corning, N. Y., shops a new 300-ton pressure car wheel press from the Giles Tool Co., of Hamilton, O., also a car wheel borer from the Putnam Machine Co., of Fitchburg, Mass.

Mr. George N. Ettenger, who has for several years been Master Mechanic of the Eastern Division of the Chesapeake & Ohio at Richmond, Va., has taken the position of Master Mechanic of the Iron Car Co., of 115 Broadway, New York City. This company is increasing its facilities and will soon be prepared to fill all orders.

Iron and Steel.

The Moss Bay Iron & Steel Co., of America, with office at Seattle, has been incorporated by Peter Kirk, L. S. J. Hunt, A. A. Denny, W. W. Williams, Jacob Furth and H. A. Noble. The capital stock is $5,000,000. The corporation will build rolling mills and blast furnaces, operate collieries and iron mines. The erection of the buildings has already begun, and will be rapidly pushed to completion.

James P. Witherow has received the contract for the erection of the buildings for the plant of the Latrobe Steel Co., at Latrobe, Pa. The buildings will be made of wrought-iron and will be fire-proof. The dimensions of the open-hearth steel department will be 250 × 80 ft. The hammer shops will be 350 ft. long, with an 80 ft. span, and will have an L the same length and 40-ft. span. The company will manufacture tires for all kinds of wheels. About 300 men will be given employment.

The new plant of the Allegheny Bessemer Steel Co., at Duquesne, Pa., is nearing completion, and is expected to be ready for operations by January. The Bessemer department is already finished and filled with modern machinery. In the rail mill hydraulic working machinery will in nearly every instance take the place of roll-hands, furnacemen, shearsmen, and hot-bed men.

The Worcester Steel Works are negotiating for the purchase of the coal mine property at Portsmouth, R. I. The mine has been disused for a number of years, because it could not be profitably worked, but the Worcester Steel Works believe they can make it pay. The coal is good only for smelting purposes, and it is for this the company wants the mine. It is possible that they will move their works to the neighborhood of the mine.

The Carbon Iron Co. has finished its additional improvements to the Ft. Pitt Iron & Steel Works, and has begun to operate the mill to work down its bearings. Horace W. Lash is the general superintendent. The additions consist of an open-hearth steel-melting plant; of two 15-ton Lash steel-melting furnaces; also a large universal mill to furnish universal rolled plates 36 in. wide, of any length or thickness.

Everything is now in readiness for starting up the works of the Oregon Iron & Steel Co., at Oswego, Ore.

The Rail Market.

Steel Rails.—About 18,000 tons have been sold during the week, mostly by Western mills to Western roads. Inquiries by Western roads amount to nearly 75,000 tons, 30,000 tons being for one system. The rails are for winter and spring work. Sales to Sept. 1 are officially reported 26,430 gross tons. Quotations, $28@$28.50.

Old Rails.—Sales of 6,000 tons by an Eastern road at $25.50, delivered at Ohio mills, and of 2,000 tons of tees at $26.25, Pittsburgh delivery, have been made. A sale of 1,500 tons at Louisville for $24 cash on board cars at Cincinnati or East St. Louis, is also reported. The stock does not now amount to more than 5,000 tons, little of which is held by Eastern roads. For tees, $25 is asked, and for double heads, $26.

Track Fastenings.—Quotations: Spikes, 2.25c., delivered; angle bars, 2.05@2.10c.

Air Brake Relief Valve.

Mr. Chas. T. Brown, an engineer on the Nashville & Decatur division of the Louisville & Nashville, has patented an improved air-brake relief valve intended to give a ready release and prevent slid wheels. It is on trial now by several railroads in the South.

Continuous Heating in New York State.

The New York State Railroad Commission was given power under an act of the last Legislature to extend the time for the equipment of railroad cars by steam heating apparatus, to certain companies under certain conditions. On the 24th inst., the commission listened to arguments by the representatives of several railroads asking that the time for the law to go into operation be extended one year. There were present Carlton S. Sprague (Grand Trunk), W. S. Bissell, coun-

sel; Master Car Builder J. S. Lentz, Master Mechanic Kinsey (Lehigh Valley), E. C. Ely (Pennsylvania), R. C. Blackall (Delaware & Hudson), and Robert McKenna (Delaware, Lackawanna & Western). The representatives of the Lehigh Valley argued that their line connects with several roads, and that cars of other roads have to be made into their trains. For this reason the law cannot be complied with until a general system is adopted.

Those present afterwards inspected the McElroy system of steam heating now in use on the Delaware & Hudson. Mr. Blackall explained the system for the benefit of a party of officials from Pennsylvania with a view of introducing the system on the Lackawanna, Lehigh Valley and other Pennsylvania roads.

Railroads in Costa Rica.

Mr. J. Richard Wingfield, U. S. Consul, writes of the railroads in Costa Rica that three lines are already built, one 70 miles long from Port Limon, on the Atlantic side, to Corrillo, which is 28 miles from San José, the capital of the country, and connected with it by a cart road. Another, 25 miles long, from Alajuela to Cartago, passing through San José; this road runs rather south of east from San José, and a road 50 miles long is now under construction and about one-third completed, connecting Cartago with the Port Limon-Corrillo line near Siquires, which is some 40 miles from Port Limon. The third and last road, 12 miles long, is from Puntarmas, on the Pacific, to Esparta, which connects with Alajuela by means of a cart road 35 miles long.

The system, complete and incomplete from Alajuela to Port Limon, with the wharf at that place, and 800,000 acres of land has been transferred to the Costa Rica Railway Co., (Limited), of London, the Government retaining one-third of the capital stock of the company. Mr. Wirgfield calls attention to the fact that on the completion of the link between Cartago and Siquires all the trade of San José will go to Port Limon, where it will be under the control of an English company. This company discriminates against American trade, and he therefore wishes the Californians to buy the road from Puntarmas to Esparta, which belongs to the Government, and continue it in Alajuela in the interest of our west coast trade. Another project recommended by Mr. Wingfield is, in view of Mr. Menocal's projected 52 ft. dam at Ochoa to raise the water of the San Juan River, to get a concession from the Costa Rican Government for a road from San José to a point on the San Carlos River, about 30 miles from the San Juan, to which point it is thought the San Carlos will be made navigable by the dam at Ohoa; this road would be about 60 or 70 miles long, and would pass through lands now undeveloped, but said to be of inexhaustible fertility, well adapted to the growth of bananas, cocoa (chocolate bean), and cattle. This road, in American hands, would give the trade of San José to us, as it would connect with our steamers passing through the canal between the Atlantic and Pacific coasts.

The Wreck of the Metlac Bridge.

The *Mexican Financier* says of the wrecking of 150 ft. of the Metlac bridge that a flood brought down trees which apparently made a dam against the low masonry piers on which iron piers rest, until the water was raised 30 ft., and the iron piers were carried out. The total length of the bridge is 500 ft., and extreme height 96 ft. The masonry piers are not high, probably 10 to 15 ft., and the spans are short. A quarter of a million dollars is said not to be an exaggerated estimate of the loss. The *Financier* thinks "there is no railroad in Mexico which may hope to escape similar disasters, and now that the most solidly-built line in the country has met with damages which interrupts its traffic for weeks, no railroad manager can feel entirely at ease regarding the best portion of his line. The difficulty in this case undoubtedly was, that the Metlac bridge was *too* "solidly built." If the spans had been greater and the stone piers higher, a bridge of less weight of iron and with fewer cubic yards of masonry would probably have passed the flood with the débris it carried. In bridge building over the ravines encountered on steep and wooded mountain sides good judgment may be more desirable than solidity.

An Elegant Postal Car.

A fine United States mail car for the Boston and Bangor route was recently completed in the Boston & Maine car shops in Salem. The car is 60 ft. in length. The inside finish is of ash, with cherry stands and tables. There is a steam heater in the centre, eleven lamps to light the room, toilet room, clothes closets, etc., to add to the convenience and comfort of the clerks. The letter and paper racks and sorting tables are of the latest and most approved pattern.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Chartiers, 2½ per cent., payable Oct. 1.

Chicago, Rock Island & Pacific, quarterly, 1½ per cent., payable Nov. 1.

Dexter & Newport, annual, 3 per cent.

Freehold & Jamesburg Agricultural, 3 per cent., payable Oct. 1.

New York Central & Hudson River, quarterly, 1 per cent., payable Oct. 15.

New York & New England, semi-annual, 3½ per cent. on the preferred stock.

Oregon Railway & Navigation Co., quarterly, 1½ per cent., payable Oct. 1.

Pittsburgh, Wheeling & Kentucky, 3 per cent., payable Oct. 1.

St. Paul, Minneapolis & Manitoba, quarterly, 1½ per cent.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama Midland, special meeting, Montgomery, Ala., Oct. 13, also Bainbridge, Oct. 16.

Cincinnati, Jackson & Mackinaw, annual meeting, Van Wert, Ohio, Oct. 3.

Cumberland Valley, annual meeting, Harrisburg, Pa., Oct. 1

Downington & Lancaster, 233 South Fourth street, Philadelphia, Pa., special meeting Nov. 5.

Dubuque & Sioux City, special meeting at Dubuque, Oct. 3, to amend the articles of incorporation and the by-laws; also to act on the purchase of the Cedar Rapids & Chicago, the Iowa Falls & Sioux City and the Cherokee & Dakota.

East Tennessee, Virginia & Georgia, special meeting, Knoxville, Tenn., Oct. 18.

Ithaca, Auburn & Western, annual meeting, 111 William street, New York City, Oct. 1.

Lake Erie & Western, annual meeting, Bloomington, Ill., Oct. 3.

Louisville & Nashville, annual meeting, Louisville, Ky., Oct. 2.

Minneapolis & St. Louis, annual meeting, Minneapolis, Minn., Oct. 3.

New York & Northern, annual meeting, 96 Broadway, New York, Oct. 15.

Ohio & Mississippi, annual meeting, Union Depot, Cincinnati, O., Oct. 11.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Mechanical Engineers* will hold its eighteenth convention and ninth annual meeting in Scranton, Pa., beginning Monday evening, Oct. 15.

The *American Institute of Mining Engineers* will hold its fifty-second meeting at Buffalo, N. Y., beginning on Tuesday evening, Oct. 2, 1888.

The *American Association of Railway Chemists* will hold its next meeting in Baltimore, Md., in October.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, at 7:30 p. m., on the third Thursday of each month.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of each month.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 67 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *Engineers' Club of Philadelphia* will hold its next meeting at the house of the Club, 1,122 Gerard street, Philadelphia, Oct. 6.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday of each month, at Pittsburgh, Pa.

The *Engineers' Club of Kansas City* meets at Kansas City, Mo., on the first Monday in each month.

American Society of Mechanical Engineers.

The ninth annual meeting of the American Society of Mechanical Engineers will be held at Scranton, Pa., beginning Monday evening, Oct. 15, and ending Friday, Oct. 19. The convention headquarters will be at the Westminster Hotel. Rates to members from $2 to $2.50 per day.

Papers will be read and discussed on the mornings of Tuesday, Wednesday and Friday, and on the afternoons of Tuesday and Wednesday visits will be paid to the works of the Lackawanna Iron & Coal Co.; the electric railways; the Dickson Mfg. Co.; the Price Brook Colliery, and the Boies Steel Car Wheel Works. Thursday, Oct. 18, will be devoted to an excursion to Hawley and Honesdale, the Moosic Mountain via the Shepperd's Crook, Carbondale and the upper Lackawanna coal field.

The following papers are to be presented and discussed at this meeting:

Rutherford, L. H.: "The Strains in an Annular Lid Resisting Internal Pressure."

Peabody, Cecil H.: "Flow of Steam in a Tube."

Peabody, Cecil H.: "A Simple Calorimeter."

Main, Charles T.: "The Use of the Compound Engine for Manufacturing Purposes."

Thurston, R. H.: "Distribution of the Internal Friction of the Steam Engine."

Thurston, R. H.: "On Variable Load, Internal Friction and Engine Speed."

Powell, S. W., and Cheney, W. L.: "System of Worm Gearing of Diametral Pitch."

Lanza, Gaetano: "Some of Tests of the Strength of Cast Iron Made in the Laboratory of Applied Mechanics, M. I. T."

Emery, Chas. E.: "The Cost of Power in Non-Condensing Engines."

Scheffler, Fred A.: "A Foundry Cupola Experience." (Continued.)

Smith, C. A.: "An Improved Method of Finding the Diameter of Cone and Step Pulleys."

Lanza, Gaetano: "Counter-balancing of Locomotives."

Denton, Jas. E.: "On the Identification of Dry Steam."

Denton, Jas. E.: "On the Friction of Piston Packing in Steam Cylinders."

Webb, J. B.: "The Overhauling of a Mechanical Power."

Webb, J. B.: "The Mechanics of the Action of the Injector."

Woodbury, C. J. H.: "On Electric Welding."

The following queries will be submitted for "Topical Discussions:"

66. What experiences and phenomena can you describe as to the conduct of steels under the conditions in which you were using them?

67. How much allowance is wise in shrinkage fits with steel?

68. What is the best form of cross section to adopt for steel castings of a complicated nature, in order to secure solidity and freedom from shrinkage cracks?

69. How often must the skin of steel be removed in grinding true gauges, etc., before change of form ceases?

70. Is there any recognized method of deciding proper sizes of tap-drills for given threads and for different materials? and, if not, would it not be advisable to formulate one based upon the amount of metal corresponding to some fraction of depth of thread to be left in the hole to be operated upon by the tap for each material?

71. What is the best method of preventing variation in pitch of screw threads, as cut by dies in the screw-machine, resulting from irregular stretching or flow of the metal, caused by the action of the dies when operating upon large numbers of comparatively long screws of small diameter?

72. Have you used power molding machines successfully in the foundry?

73. Wherein do the bucket curves of modern turbines differ from those derived from purely theoretical considerations?

74. What limit is there to the speed of caloric or hot air engines?

Railroad tickets at reduced rates can be obtained through the Secretary, 280 Broadway, New York.

American Institute of Mining Engineers.

As has already been announced, the fifty-second meeting of the Institute will be held at Buffalo, N. Y., beginning on Tuesday evening, Oct. 2, 1888. The following programme is provisionally announced: Tuesday evening, Oct. 2, opening session and reception; Wednesday, an excursion to Dunkirk, N. Y., visiting the Brooks Locomotive Works; Thursday, sessions and local excursions; Thursday evening, subscription dinner; Friday, excursion to Lockport, N. Y., visiting the Cowles Electric Reduction Works; Saturday, excursion to the rock-salt mine of the Retsof Company, at Pifford's, N. Y. The price of tickets for the subscription dinner has been fixed at $6 for gentlemen and $3 for ladies. A detailed programme will be issued by the local committee and distributed to members and guests at Buffalo. Special railroad rates have been secured, contingent upon their use by not less than 100 persons in all from the Trunk Line Association, the Central Traffic Association and the Southern Passenger Association.

Boston Society of Civil Engineers.

A regular meeting was held Sept. 19. Forty-eight members and nine visitors were present. Messrs. Louville Curtis and William M. Scanlan were elected members. The secretary was directed to acknowledge in the name of the society its appreciation of the kind attention received from various people and companies on the occasion of the excursion to Providence and Newport. The secretary read a paper from the Board of Direction of the American Society of Civil Engineers, containing an offer to send the Transactions of that society to any subscriber at the rate of $10 per year, and to clubs of ten or more, at 25 per cent. discount. The committee appointed to consider communications from the Engineers' Club of Kansas City and the Western Society of Engineers, submitted a report on the matter of specifications for highway bridges, which was, in substance, that the society should proceed very cautiously in the matter of recommending any legislative action which would result in state inspection of highway bridges, as it does not appear certain that this method would secure the building of proper structures; that the society should not take action in reference to establishing rates for professional services of civil engineers, but recommending the society to take appropriate action on the subject of improvement of highway bridges, and advising the appointment of a committee to consider and report what legislative or other action would be advisable. The report was accepted, and the same committee, *i. e.*, John E. Cheney, D. H. Andrews and Edward S. Shaw, was appointed to carry out the recommendations of the report. Prof. Dwight Porter read a paper on the "Removal of Roof Water," and Mr. J. Pickering Putnam a paper on "House Drainage," both of which were discussed.

Civil Engineers' Society of St. Paul.

A regular meeting was held Sept. 3. F. W. McCoy was elected Treasurer. Mr. McCoy read a paper on Street Improvements in St. Paul, giving a résumé of the amount, cost and variety of different improvements made during the past two years, and Mr. J. D. Esterbrook, Superintendent of Parks, read a paper on Changes of Level in the Northwestern Lakes, illustrated by maps and charts, showing the variations of the lake levels and making comparisons of rainfalls for the last 25 years.

New York Railroad Club.

A business and social meeting of the New York Railroad Club will be held at its rooms, 113 Liberty street, Oct. 11, at 7.30 p. m., for the purpose of making arrangements for the regular monthly meetings during the coming season, and for selecting the subjects for discussion.

Station Agents' Association.

The fourth annual meeting of the Railway Station Agents' Association was held last week at the Grand Pacific Hotel in Chicago. The following were elected officers of the association: L. A. Clark, of Carlsbad, Cal., President; F. D. Lindsley, of Iowa City, Vice-President; O. L. Rickard, of Merrillon, Wis., Secretary, and G. L. Spink, of Princeton, Ky., Treasurer.

PERSONAL.

—Mr. J. H. Setchel, lately Superintendent of the Brooks Locomotive Works, has accepted a position with the Martin Anti-Fire Car Heating Co., of Dunkirk, N. Y.

—Mr. J. N. Bass, General Superintendent of the Americus, Preston & Sumpkin, died on Sept. 22, at Cartersville, Ga., where he went recently for the benefit of his health. Mr. Bass was formerly Superintendent of the Port Royal & Western North Carolina.

—Mr. W. W. Finley, General Freight Agent of the Texas & Pacific, has resigned that position to become General Freight Agent of the Fort Worth & Denver City, Denver, Texas & Fort Worth, and Denver, Texas & Gulf roads, succeeding Mr. George A. Sanderson, resigned.

—Mr. Elliott Holbrook, General Superintendent of the Pittsburgh & Lake Erie, has resigned that position and has been succeeded by J. W. Patterson. Mr. Holbrook was appointed to the office named in July, 1887, and was formerly for several years Division Superintendent of the New York & New England.

—William Syms, an old baggage-master of the Pittsburgh, Fort Wayne & Chicago, committed suicide by shooting himself in his car, on the road west of Salem, O., on Monday morning last. An express messenger was in the same car, and his revolver was used by the suicide; but the messenger, who was asleep, was not awakened by the report.

—Mr. C. R. Barnhart has resigned the position of General Master of Transportation of the Central of Georgia on account of ill health. Mr. Barnhart has only held this position since March last, and was previously connected with the Louisville & Nashville system for a number of years, his last position being that of Superintendent of the Louisville, Cincinnati & Lexington division.

—Mr. Robert Bassel, who has for the last year and a half been the technical attaché of the German Legation at Washington, has resigned his position, and sailed for Europe Wednesday. Mr. Bassel has been specially interested and energetic in studying the railroads of the United States, and has traveled over the greater part of the union and of the Dominion of Canada in pursuit of information. He will probably take a place on the German state railroads.

—Josiah D. Hayes, for years a prominent business man of Detroit, died suddenly in that city, Sept. 23, at the age of 63 years. He was born in Clayton, N. Y. When the Grand Trunk was completed to Detroit, in 1859, he was appointed General Agent of that road. In 1861 he went into the employ of the Michigan Central, and in 1869, upon the resignation of C. I. Hurd, he was appointed Assistant Superintendent. He has been largely connected with several Detroit industries. He was an able speaker and writer.

—Mr. Jas. L. Randolph, the veteran consulting civil engineer of the Baltimore & Ohio, died suddenly at his home, near Jessups, on the Washington Branch, Sept. 17. Mr. Randolph entered the service of the company about the year 1836, and spent his long and useful life in various capacities in the engineering department. He was one of the earliest railroad engineers in this country and had to do a great amount of original research. Among the more important works that he carried out was the location and construction of the Chicago Division of the Baltimore & Ohio.

—John G. Brill, senior member of the firm of John G. Brill & Co., and founder of the Philadelphia Car Works, died at his residence in Philadelphia, Sept. 22, at the age of 71 years. Mr. Brill came to this country from Germany in 1840, and after working a number of years at his trade of cabinet making, he went into the business of car building. Among the floral offerings at the funeral were a large wheel, with a broken axle, from the employés of the J. G. Brill Co., inscribed "In memory of our President," and a large pillow of natural roses, bearing the words, "In memory of the work of an honest man," from W. C. Allison. The employés of the car works attended the funeral in a body.

—Mr. Andrew Watson has tendered his resignation as General Superintendent of the Duluth, South Shore & Atlantic, to take effect Sept. 30. Mr. George T. Jarvis has been appointed Acting General Superintendent of the company. Mr. Watson was connected with some of the leading roads of Canada and Michigan before his selection to succeed Mr. McCool as General Superintendent of the Detroit, Mackinac & Marquette. On the consolidation of the Marquette, Houghton & Ontonagon with the first named road to form the Duluth, South Shore & Atlantic, Mr. Watson became the General Superintendent of the consolidated line. Mr. Jarvis was appointed Superintendent of this road last February. Previous to that he had been Division Superintendent of the Mexican Central. He has also been connected with the Pennsylvania.

ELECTIONS AND APPOINTMENTS.

Atlantic & Danville.—F. L. Pitman has been appointed Chief Engineer to succeed George S. Bruce, resigned.

Birmingham Mineral.—E. H. Stollenwerck has been appointed Chief Train Dispatcher, with headquarters at Bessemer, Ala.

Buckhannon.—The incorporators of this West Virginia company are: Senator J. N. Camden, Hon. W. N. Chancellor, V. B. Archer and J. N. Camden, Jr.

Chattanooga, Cleveland & Murphy.—The incorporators have chosen the following officers: President, E. Watkins, Chattanooga, Tenn.; Vice-President, H. E. Colton, Murphy, Tenn.; Secretary and Treasurer, W. G. McAdoo.

Central of Georgia.—Mr. W. P. Savage has been appointed General Master of Transportation, with headquarters at Savannah, Ga., in place of C. R. Barnhart, resigned.

Chicago, Burlington & Quincy.—John H. McPartland has been appointed Assistant Superintendent of the Middle Iowa division, with headquarters at Ottumwa, Ia. J. M. Bechtel has been appointed Division Freight and Passenger Agent of the Iowa division, with headquarters at Burlington, Ia., to take effect Oct. 1, succeeding W. J. Davenport, who is appointed Assistant Division Freight and Passenger Agent of the Iowa division, with office at Creston, Ia. Edwin R. Puffet has been appointed Division Freight Agent of the Chicago division, with office in Chicago. Robert N. Rogers, Jr., General Agent at Kansas City, has been appointed Division Freight Agent of the Galesburg division, vice R. T. Davis, resigned, with office at Galesburg. L. C. Taorne has been appointed General Agent of the Rock Falls branch, with office at Sterling, Ill.

Chicago, Milwaukee & St. Paul.—W. G. Collins has been appointed Assistant General Superintendent, with headquarters at Minneapolis, to succeed C. W. Case, resigned.

Columbus & Eastern.—The following have been elected officers of the reorganized company: Granville P. Hawes, of New York, President; F. J. Picard, Vice-President; H. D. Turney, Treasurer, and W. E. Guerin, General Solicitor and Secretary.

Denver Park.—The following are the officers of this road: J. W. Strayer, President; A. W. Chamberlain, Vice-President; E. W. Merritt, Secretary, and J. B. Shepard, Treasurer.

Dodge City, Montezuma & Trinidad.—The following are named as directors in the charter filed in Colorado: J. W. Gilbert, R. R. Hudson, William W. Munsell, Wilson Soule and A. T. Soule, all of Kansas.

Duluth, South Shore & Atlantic.—George T. Jarvis has been appointed Acting General Superintendent, the appointment to date from Sept. 30, 1888, Andrew Watson having tendered his resignation as General Superintendent, to take effect that date.

Georgia, Carolina & Northern.—John G. Williams has been appointed Acting Auditor, with office at Monroe, N. C.

Henderson State Line.—The following officers have been elected: S. K. Sneed President; John H. Barret, Jr., Vice-President, and S. L. Marshall, Secretary.

Indianapolis & St. Louis.—J. Q. Van Winkle has been appointed Superintendent, with headquarters at St. Louis, Mo., to succeed T. W. Burrows, who resigned to become Superintendent of the Chicago & Atlantic.

Kansas City, Memphis & Birmingham.—L. L. Crisp has been appointed Contracting Freight and Passenger Agent of this road and the Kansas City, Fort Scott & Memphis, with headquarters at Memphis. His territory will be West Tennessee, Northern Mississippi and Eastern Arkansas.

Kansas City & Sabine Pass.—The following officers have been elected: Vice-President, D. J. Haynes, of Kansas City; Secretary, Austin Kerr, of Kansas City; Treasurer, C. C. Hickok, of New York; Manager, William Anderson, of Kansas City.

Marysville, Sutter City & Colusa.—The directors of the company are: Alexander Badlam, John L. Boone, W. C. Lynde, W. H. L. Barnes, W. H. Ward, W. N. Letcher and W. H. Thompson.

Middletown & Crawford.—At the annual meeting last week, the old board of directors was re-elected, except that A. R. McDonald, of New York, was elected to fill a vacancy.

Minneapolis, St. Paul & Sault Ste. Marie—The annual meeting of the company was held in St. Paul last week, and the following directors were elected: W. D. Washburn, Thomas Lowry, John S. Pillsbury, John Martin, R. B. Langdon, O. C. Merriman, C. H. Pettit, John C. Oswald, Charles J. Martin, M. B. Koon, E. W. Herrick and A. H. Linton, Messrs. Herrick and Linton succeeding W. H. Eustis and J. M. Shaw, who retired. A meeting of the new board of directors was held subsequently, at which the following officers were elected: President, W. D. Washburn; Vice-President, Thomas Lowry; Executive Committee, W. D. Washburn, J. S. Pillsbury, Thomas Lowry, R. B. Langdon and John Martin.

Missouri Pacific.—James W. Way has been appointed Chief Engineer, with office at St. Louis. He will have charge of all new construction and all matters pertaining to right of way.

Northern Pacific.—At the annual meeting in New York, Sept. 20, 697,233 shares were represented, out of which 361,440 shares, or a majority of 12,824 shares, were voted by Henry Villard and associates. His vote included 135,695 shares represented by Brayton Ives. The following directors were unanimously elected: Thomas F. Oakes, Frederick Billings, Charles L. Colby, C. B. Wright, John B. Trevor, Henry Villard, E. H. Abbot, C. T. Barney, Colgate Hoyt, Brayton Ives, Robert Harris, John U. Brookman, John C. Bullitt. The only change is the election of J. C. Bullitt, of Philadelphia, in place of August Belmont, who declined a re-election. At the subsequent meeting of the directors Thomas F. Oakes was chosen President, and Robert Harris, the former President, was made Chairman of the Board of Directors. President Oakes will remain at St. Paul. James B. Williams was chosen First Vice President, to have charge of the New York office, and C. H. Prescott, of Portland, Oregon, was elected Second Vice-President, with headquarters on the Pacific Coast. The other officers were re-elected; Samuel Wilkeson, Secretary; George S. Baxter, Treasurer, and J. A. Barker, General Auditor.

Oregon & Washington Territory.—The following appointments have been made: Rowland Smith to be Auditor, and C. W. Taylor to be Train Master, with headquarters at Hunt's Junction, W. T.

Pittsburgh & Lake Erie.—J. W. Patterson has been appointed General Superintendent, to succeed Elliott Holbrook, resigned.

J. B. Zohoe has been appointed Master of Transportation and Superintendent of Telegraph.

Puget Sound, Skagit & Eastern.—The following are the trustees of this company: John Campbell, of Maryport, England; H. W. Wheeler, J. M. Moore and W. E. McMillan, of Seattle. The principal office is to be at Seattle.

Richmond, College Corner & Cincinnati.—The following are the first board of directors of this Indiana company: Henry Cutter, Everett A. Richey, LeRoy Keller, Charles T. Henchman, Alvin E. Crocker, James E. Taylor, John H. Nicholson, Wm. M. Thompson and George L. Cates.

The directors have elected the following officers: Leroy Kelly, President; William Thompson, Vice-President; E. A. Richey, Secretary, and George Coates, Treasurer.

Saginaw, Tuscola & Huron.—Robert Loughlin has been appointed Superintendent, vice M. B. Wilkinson, resigned.

St. Johns, Lake Weir & Gulf.—W. H. Wren, of Lynchburg, Va., is President of this Florida company, and Wm. E. Strong, of Belleview, Marion County, Fla., is Chief Engineer.

St. Louis & Chicago.—The incorporators are as follows: L. S. Graves, A. J. Moorehead, W. T. Witmer, W. O. Browning and L. L. Chapman, all of Springfield, Ill.

St. Paul, Minneapolis & Manitoba.—The postponed annual meeting was held at St. Paul, Sept. 25. Of the capital stock, nine-tenths, or 180,000 shares, were voted. In the Board of Directors, Henry D. Minot and Allan Manvel, of St. Paul, succeeded F. P. Alcott, of New York, and D. C. Shepard, of St. Paul. The only change in the executive department is the substitution of Mr. Manvel as Vice-President for John S. Kennedy.

Sault Ste. Marie & Southwestern.—N. C. Foster, of Fairchild, Wis.; M. Griffin and James McIntyre, of Eau Claire, and William Hale and W. P. Tearse, of Winona, Minn., are the incorporators of this company.

Southern Pacific.—H. J. Small, Superintendent of Motive Power and Machinery, announces the following appointments: "From and after Oct. 1, 1888, the office of General Master Mechanic will be abolished. Mr. William McKenzie is appointed Chief Engineer of steamers and Master Mechanic of the Western San Pablo and Joaquin divisions and branches, with headquarters at West Oakland, Cal. Mr. T. W. Heintzleman is appointed Master Mechanic of the Oregon, Benicia & California Pacific divisions and branches, having charge of the Locomotive Works at Sacramento, with headquarters at the latter place. Appointments in effect Oct. 1, 1888."

Tacoma, Olympia & Chehalis Valley.—The trustees of this new company are as follows: A. C. Smith, W. B. Allen, G. W. Thompson, C. S. Torkelson and M. G. Denton, of Tacoma, W. T.; George H. Ellsbury, of Tower City, Dakota; F. H. Miller, of Centralia, W. T.; Charlemagne Tower, of Philadelphia; George P. Wilson, of Minneapolis, and Herman Trott and W. R. Marshall, of St. Paul.

Tennessee & Coosa.—A. K. Rison, of Huntsville, Ala., has been appointed Receiver of this road.

Trinidad, Caldwell & Arkansas.—The first board of directors of this Kansas company are as below: J. L. McFee, P. O'Connor, J. W. Ross, S. P. Lewis, John W. Nyce, of Caldwell, Kan.; S. B. Darraugh, O. Jennings and G. R. Snelling, of Anthony, Kan.; C. S. Jobes and S. C. Bell, of Attica; O. C. Ewart and R. D. Cunningham, of Medicine Lodge; C. T. Avery, of Coldwater; W. B. Roberts, of South Haven, and T. G. Hunter, of Bucklin, Kan.

Williamsport & Binghamton.—The officers of this company are: President, F. M. Ward; Secretary, C. F. Camp; Chief Engineer, A. B. Berthoud, New York. The principal office is at Williamsport, Pa

OLD AND NEW ROADS.

New Roads.—Bridgeport Junction.—Buckhannon.—Denver Park.—Florence Northern.—Hackett City, Greenwood & Eastern.—Henderson State Line.—Puget Sound, Skagit & Eastern.—Richmond, College Corner & Cincinnati.—Sault Ste. Marie & Minnesota.—Tacoma, Olympia & Chehalis Valley.—Trinidad, Caldwell & Arkansas.

Alabama Midland.—The company has secured control of the Northwest & Florida, which extends from Montgomery south to Luverne, Ala. The Alabama Midland will build a road from a point on the Montgomery & Florida to Troy, Ala., and Bainbridge, Ga.

Atlanta & Florida.—The surveying corps has reached Isabella, about 50 miles south of Fort Valley, Ga., on the preliminary survey for the southward extension. The surveyors report an excellent line so far as they have gone.

Atlantic, Atlanta & Great Western.—The locating surveys between Atlanta and Eatonton, Ga., are to be begun at once, and the preliminary survey from Eatonton to Savannah is to be completed without delay.

Atlantic & Danville.—This company offers to change its line so as to enter Danville, Va., by a route south of the Dan River, provided that $50,000 additional municipal aid is granted. The time limit, which is a condition of the subscription already granted the road, is likely to expire before the work can be completed, and the city has been asked to extend it.

Baltimore & Eastern Shore.—Chief Engineer Thorp has made a new location of this proposed Maryland road, from Preston to Salisbury, and negotiations are now pending with a firm of contractors for the building of the road. About $75,000 more is still needed, however. There is hope of securing further municipal aid. The President of the company is J. B. Seth, Easton, Md.

Bridgeport Junction.—This company has been chartered in Pennsylvania to connect the town of Bridgewater, on the Pittsburgh & Lake Erie, with the Cleveland & Pittsburgh road, at Beaver Creek Bridge. The line will be two miles long.

Buckhannon.—Chartered in West Virginia to build a road from Buckhannon up the Buckhannon River to the Three Forks of that river, at or near the Randolph County line. The principal place of business will be Weston.

Central of Georgia.—During the recent flood in Georgia 70 miles of track on the road is said to have been under water for nearly a week, and the loss to the company on account of high water will be very great. At Augusta the yards were entirely flooded. The main line has now been repaired but the Augusta yards are still in very bad shape.

Chattanooga, Rome & Columbus.—The Chattahoochie Brick Co. has filed a bill in the United States Court at Atlanta, Ga., for the appointment of a Receiver. The bill recites that the Chattahoochie Brick Co. is owed a large sum of money for building the road, and that the railroad company and the Rome & Carrollton Construction Co., which operates the road, are insolvent. The Court declined to appoint a Receiver, and has ordered the construction company to answer the bill. The construction company denies that it is insolvent, and claims that its contract with the Chattahoochie Brick Co. provides that the President of the construction company has authority to withhold $125,000 from the Chattahoochie Brick Co. to idemnify the construction company for any failure upon the part of the city of Chattanooga to deliver the bonds voted by the city to the railroad. The company also claims that the work of the Chattahoochie Brick Co. has been over-estimated to the extent of at least $100,000.

The road is being examined by a corps of engineers, who will render their report in 10 or 15 days. The property will be classified, and the work estimated for the information of the Court in the legal actions which will grow out of the request for a receiver.

Chicago & Indiana Coal.—On the extension from Goodland Junction, Ind., to a connection with the Chicago & Eastern Illinois, tracklaying has been completed. It will be opened for traffic early next month.

Chicago, Madison & Northern.—The company is progressing with the completion of its line into Chicago, and has reached the town of Cicero. It is understood that while the company is desirous of getting its own line into Chicago, it may still make arrangements to come in either by the Wisconsin Central or the Chicago, Burlington & Quincy.

Columbus & Eastern.—The property of the Columbus & Eastern Railroad Co., recently sold at foreclosure sale, has been acquired by the Columbus & Eastern Railway Co. The road extends from Columbus to Zanesville, O., 67 miles, and into the Perry and Muskingum County coal fields. The new company will improve the road and add largely to its equipment.

Columbus, Hocking Valley & Toledo.—James C. Carter, E. W. Kittredge and Lawrence Maxwell, Jr., the arbitrators chosen to determine the $8,000,000 suit of the road against its ex-President, Stevenson Burke, and the former directors of the road, who were deposed in January, 1887, when the control of the road passed into the hands of John W. Shaw, who is now the President, and his associates, have rendered a decision in favor of the defendants. The suit involved the issuance of $8,000,000 of bonds in 1888. The new management claimed that when they took charge there was nothing to show for these bonds except the stock of the Hocking Valley Coal Co., having a par value of $1,500,000. Suit was brought at once, and the litigation has continued ever since.

Davenport, Iowa & Dakota.—The company has filed a mortgage with the Recorder of Buchanan County, Ia., to secure a loan from the Farmers' Loan & Trust Co., of New York, for $16,000 per mile of completed road. The road is to run from Davenport to the north line of Dakota and from Davenport to a point in Eastern Illinois. The mortgage dates from June 1, 1888, and is to run 38 years at 6 per cent interest. It is signed by James T. Lane, President, and C. H. Fulton, Secretary.

Denver Park.—The company has filed a charter at Denver, Col., to build a suburban motor road three miles in length.

Dodge City, Montezuma & Trinidad.—The company has filed articles of incorporation in Colorado for the extension from Montezuma, Kan., to Trinidad, Col.

Duluth, South Shore & Atlantic.—The line from Nestoria Junction to Iron River Junction, 165 miles, was opened for traffic Sept. 17, and will be known as the Duluth Division. An alternate daily mixed train service has been established between Nestoria Junction and Duluth, using the tracks of the Northern Pacific between Iron River Junction and Duluth.

Eastern of Minnesota.—The road has now been opened for traffic its entire length from Hinckley to West Superior, Wis., a distance of 70 miles. The road gives the St. Paul, Minneapolis & Manitoba an outlet from the West to Lake Superior.

Evansville & Richmond.—Oliver Ferguson & Son, of Indianapolis, have been awarded the contract for building the road from Elnora, on the Evansville & Indianapolis, via Bedford to Columbus, Ind. From Columbus to Richmond the line has not been fully decided upon. The contractors expect to have a large force of men at work within a few days. The D. J. Mackey syndicate is said to be behind the enterprise. O. H. Kurtz, Princeton, Ind., is one of the officers of the company.

Florence Northern.—This company, recently chartered in Albama, has filed a charter in Tennessee to build a road from a connection with the Alabama line at a point on the state line between Alabama and Tennessee in Wayne County, and thence north through Wayne, Perry, Decatur, Henderson, Gibson, Carroll and Henry counties to the Kentucky state line in the direction of Paducah. A branch line will run through Lewis, Hickman, Dickson and Montgomery counties to Clarksville, and north to the Kentucky state line in the direction of Hopkinsville.

Freehold & New York.—This road was sold at public auction this week by Anthony Reckless, the trustee for the first mortgage bondholders. It was purchased by E. D. Adams, of Winslow, Lanier & Co., of New York, for $70,000. The sale disposes of all claims against the road except the first mortgage bonds, which amount to $200,000. The Central of New Jersey holds $135,000 of the bonds and Brown Brothers & Co. about $60,000 worth. The road extends from Freehold to Keyport, N. J., 15 miles.

Gloucester City & Atco.—The city council of Gloucester, N. J., has been asked to grant right of way for this road, which is understood to form part of a new route south from New York, for the United States Express Co. The road will be 17 miles long, and will connect at Atco with the New Jersey Southern.

Hackett City, Greenwood & Eastern.—Charter filed in Arkansas. The company is to build a road to commence at Hackett City, in the County of Sebastian, and run via Greenwood to Alma, a point on the Little Rock & Fort

Smith. The road will pass through rich coal fields. The capital stock is $300,000.

Henderson State Line.—The company has been organized at Henderson, Ky., to build a road from Henderson through Davies, McClellan, Ohio, Butler and Warren counties to Bowling Green.

Hereford.—Shirley & Corbett, the contractors for this Canadian road, have defaulted, leaving their laborers unpaid. A force of about 400 Italians threatened to tear up the rails, but the militia has been called out, and no further trouble is feared.

Illinois Central.—The formal decree in the great lake front case was entered by Judge Blodgett this week in the Federal Court, at Chicago. The decree is in conformity with the opinion delivered by Justice Harlan and Judge Blodgett last spring. The railroad is enjoined from erecting structures in or filling any portion of the bed of Lake Michigan as it now exists east of the grounds now occupied by it between the Chicago River and Randolph street, and Randolph street and Sixteenth street.

Keokuk & Northwestern.—A. B. Stone, tru tee, of Columbus, O., has filed in the Federal Court, at Keokuk, a suit against this company for the foreclosure of the first mortgage bonds which, together with the accumulated interest, amount to $700,000. The appointment of a receiver is also asked. The Chicago, Burlington & Quincy and the St. Louis, Keokuk & Northwestern roads are made defendants to the suit.

Mayrsville, Sutter City & Colusa.—Grading will probably be soon commenced on this California line, and it is expected to have it completed from Marysville west about 10 miles to Sutter City early next spring. Arrangements have been made with the Southern Pacific for the road to run on the present Southern Pacific bridge connecting Marysville with Yuba City, and along the Southern Pacific grade for a distance of three miles.

Mexican National.—The company has decided to erect six large hotels alone the line of the road between Laredo, Tex., and the city of Mexico. They will be in charge of Mr. G. Hodges as superintendent. Great complaint has been made against the inadequate hotel facilities in large cities in Mexico. It is understood that the International & Great Northern depot in Laredo will soon be used as a Union depot by that line and the Mexican National, and that the roads will make close connections at Laredo and run through sleepers from St. Louis to that point.

Missouri Pacific.—Articles of agreement and consolidation between the Missouri Pacific, St. Louis & Lexington, Kansas City & Eastern, Lexington & Southern, St. Louis, Kansas & Arizona, and the Kansas City, Leavenworth & Atchison railroad companies, forming one company and named the Missouri Pacific, have been filed with the Secretary of State of Colorado. The capital stock of the consolidated company is $30,000,000. The headquarters of the company are at St. Louis, and at Pueblo for the state of Colorado. All unissued bonds in each separate company are to have the same effect and to be issued in the same manner as heretofore, and each company is also responsible for debts, etc., contracted previous to the consolidation.

Mobile & Ohio.—The company has decided to build a line to Birmingham, Ala., from Corinth, Miss. Corinth is in the extreme northwest corner of the state at the junction of the Mobile & Ohio and the Memphis & Charleston roads. The distance from Corinth to Birmingham would be about 140 miles. The branch, if built, will parallel the Kansas City, Memphis & Birmingham for about 100 miles. There is little prospect of anything being done in the near future, toward building, however.

New York, Lake Erie & Western.—The double tracking of the Jefferson branch, between Susquehanna and Carbondale, Pa., 39 miles, has been finished. The branch is the Erie's principal coal feeder. The improvements made upon it include two new iron bridges.

The work of double tracking the Niagara Branch from East Buffalo to Walden avenue, will be completed by Dec. 1.

The road has just begun extensive improvements at Susquehanna. A tract of land adjoining the yards has been bought, and new shops will be erected. The principal new building will be a large iron foundry, where most of the work of that description will be done for the entire line.

The company has also commenced the grading for new coal pockets at Hornellsville, N. Y., which, when completed, will have a storage capacity of 12,000 tons. There are also under construction two new water stations, one at Cuba and one at Belvidere, N. Y.

North Attleboro & Wrentham.—The Railroad Commissioners of Massachusetts this week gave a hearing on the petition of the company for the privilege of constructing a line from Attleboro, Mass., on the Old Colony, through Wrentham to Adamsdale, on the New York & New England. The capital stock of the new corporation is to be $200,000, besides which there would be $200,000 of bonds issued. The Commissioners reserved their decision.

Northern Pacific.—At the annual meeting in New York resolutions were unanimously passed approving of the lease by the Northern Pacific of certain Montana branch lines, and of the contract entered into by the company with the Northwest Equipment Co., of Minnesota.

Paducah & Hickman.—The incorporators of this road have ordered an immediate survey, and it will begin at once under Maj. J. W. Robinette.

Pennsylvania.—The pressure of business between New York and the West has made it necessary to secure greater terminal facilities on New York harbor. Contracts have just been awarded for the construction of a coal pier at Harsimus Cove, Jersey City, 1,200 ft. long by 80 wide, on which is a trestle for cars. Coal chutes will be put in, and coal can be dumped directly into vessels. At South Amboy a freight pier, 1,200 ft. long by 60 wide, for the trans-shipment of general merchandise, will be built.

Portland & Vancouver.—The road has been completed from East Portland, Ore., to the Columbia River opposite Vancouver, Wash. Ter. The distance is 8 miles. Work is being pushed on the long trestle out into Columbia River.

Pueblo, Gunnison & Pacific.—The preliminary survey was commenced last week under Thomas Ropes, of Topeka, Kan. The road is projected to extend from Pueblo to Gunnison, Col.

Puget Sound, Skagit & Eastern.—The company has filed a charter in Washington Territory to build a road from Burrow's Bay, in Skagit County, in a general easterly direction to Camp Spokane on the Columbia River, in Lincoln County; and to build branch lines in Washington, Oregon and Idaho. The capital stock is $300,000.

Richmond, College Corner & Cincinnati.—Chartered in Indiana to build a road from Richmond, Ind., to College Point, O., a distance of 17 miles. At College Corner it will connect with the Cincinnati, Hamilton & Indianapolis, giving Richmond a competing line with the Panhandle, that company having recently secured control of the line from Richmond to Hamilton. The capital stock of the new company is $250,000.

St. Louis & Chicago.—The company has filed articles of incorporation in Illinois for the extension from Litchfield to East St. Louis, about 50 miles.

St. Paul, Minneapolis & Manitoba.—Tracklaying on the Cando branch has been finished. The line is 54 miles long. Tracklaying began on July 31. On the Duluth, Wilmer & Sioux Falls line the track is laid for 96 miles from Wilmer.

Sault Ste. Marie & Minnesota.—The company has filed articles of incorporation in Minnesota to build a road from Rhinelander, Wis., to Winona, Minn. The capital stock is $16,000,000 and the limit of indebtedness is $5,000,000. The general offices and principal place of business are to be at Winona.

Silver Lake.—A project to extend the road from Perry, in present terminus, to Moscow, in the County of Livingston, N. Y., to connect with the Delaware, Lackawanna & Western, is being discussed.

Somerset.—Track on the extension from North Anson to Bingham, Me., has been laid into Embden. Work on the grading is progressing well, and it is thought the road will be completed to Carratunk Falls before winter.

Sonora, Sinaloa & Chihuahua.—The Mexican Government has authorized the company to issue bonds and stock, secured by a mortgage on the road.

South Atlantic & Ohio.—The control of this road, which extends from Bristol, Tenn., northwest about 40 miles, and which is to be extended to Big Stone Gap, on the line between Virginia and Kentucky, has passed into the hands of Dr. J. M. Bailey, President of the Bailey Construction Co., who has bought all the stock and bonds. Dr. Bailey has also bought about 30,000 acres of mineral and coal lands lying contiguous to the line of the proposed extension, together with 1,000 acres of town lots in Bristol, Tenn., and a similar quantity in Elizabethton, about 20 miles south on the Watauga River, in the magnetic ore regions. These purchases aggregate $1,200,000, and Dr. Bailey has also bought out the interests of the Virginia, Tennessee & Carolina Steel & Iron Co., in this region. The money has been provided for the building of the road to Big Stone Gap. Bonds of the road are now for sale. The Louisville & Nashville is to extend its Cumberland Valley branch from Pineville to Big Stone Gap, where connection will be made with this road.

Arrangements are completed for the erection of a large furnace with 160 tons daily capacity at Bristol for producing Bessemer steel. The plan proposes two furnaces of that size and a rolling mill.

State Geologist, Proctor, of Kentucky, in a report on the iron and coal fields along the line of this road makes enthusiastic statements concerning their value. In the region of Big Stone Gap there are large fields of superior coking coal. These fields are the nearest of any to the large deposits of high grade Bessemer steel ores in East Tennessee and Western North Carolina, and this road will be the shortest route from the coke to the ore fields. Immense deposits of "Red Fossil" ore run contiguous to the road for a distance of 14 miles. Analyses show that it will yield from 45 to 50 per cent. metallic iron and it can be mined at from 50 cents to $1 per ton. There are a number of other large fields. The Norfolk & Western branch into the Cripple Creek region developed a large traffic in minerals in 5 years, and it is believed this region will be equally prosperous. The country along the road abounds in timber and beautiful variegated marbles. Investments have already been made in this region by iron and steel manufacturers of Pennsylvania.

Southern Pacific.—Ricker, Lee & Co., of Galveston, Tex., have secured the contract to build the extension from Victoria to Beeville, Tex., a distance of 57 miles. They will begin work at once.

Tacoma, Olympia & Chehalis Valley.—Articles of incorporation filed in Washington Territory to build a road from a point on Gray's Harbor, thence easterly through the Chehalis and Hannaford valleys across the Cascade range to a point on the Columbia River, Eastern Washington, traversing the counties of Chehalis, Thurston, Lewis and Yakima. A branch will probably run north to Tacoma, where the company will have its headquarters. The capital stock is $1,000,000.

Temiscouata.—A severe land-slide occurred on this road last week, and it is said that the damage done will involve considerable loss to the contractors and necessitate a long delay in opening the road. The track will need to be moved farther back from the banks of Temiscouata Lake, so as to afford protection from the water, the action of which, it is believed, caused the trouble.

Texas & Pacific.—No definite plan has been agreed upon yet for the building of the branch lines to the pine forests west of Alexandria, La., nor has the location of lines been agreed upon. A conference is expected very soon to take steps in the matter.

Toledo, Ann Arbor & North Michigan.—The construction of the extension from Cadillac to Frankfort, Mich., 63 miles, has been commenced. When this extension has been completed the company will control a line from Lake Erie to Lake Michigan.

Trinidad, Caldwell & Arkansas.—Charter filed in Kansas to build a road from Bucklin, Ford County, southeasterly through the counties of Ford and Kiowa, to Coldwater, Comanche County, thence through Barber County to Medicine Lodge and to the city of Attica, Harper County, thence to Anthony, Sumner County, thence to Caldwell and South Haven, and thence through Cowley County to Arkansas City; estimated length, 200 miles. The headquarters of the company will be at Caldwell. The capital stock is $2,000,000.

Uniontown, Newberne & Southwestern.—The survey has been completed for this road, which is to extend from Newberne via Uniontown, Ala., to the Tombigbee River, a distance of 52 miles. Right of way and subscriptions to the amount of $50,000 have been donated. The company will do its own construction work and will not let any contracts. J. C. Welsh, Uniontown, Ala., is one of the directors.

Vancouver, Klickitat & Yakima.—Notice has just been filed with the Secretary of Washington Territory that at a recent meeting of the stockholders the capital stock of the company was reduced to $60,000, the company being free from debt and liabilities.

Ventura & Ojai Valley.—The company has been incorporated in California to build a road from Ventura to Nordhoff. The incorporators are: E. L. Buck and J. W. Gardner, of Santa Ana; J. H. Wiley, of San Francisco, and James Huntington, of Nordhoff.

Versailles & Midway.—Grading has been completed on the Georgetown extension, thirteen miles, and a large force began laying rails last week.

Vincennes, Oakland City & Owensboro.—The Central Construction Co., of Henderson, Ky., has been given the contract for building this road from Vincennes, Ind., via Oakland City, to the Ohio River at Owensboro, and grading was commenced last week.

Washington & Idaho.—The company has filed supplemental articles of incorporation to build the following lines of road: From Farmington to Spokane Falls; from a point on this line near the forks of Hangman Creek, northerly across the Cœur d'Alene Reservation to a point on Cœur d'Alene Lake, and to the Cœur d'Alene River, easterly to the Cœur d'Alene Mission and thence southeasterly along the south fork of the Cœur d'Alene River to Wardner; from near Spangle, northeasterly to a point on Cœur d'Alene Lake, about 5 miles north of the mouth of the Cœur d'Alene River; from the town of Milo, Idaho, along the south fork of Cœur d'Alene River to the town of Mullan, Idaho; from Mullan, easterly, across the Bitter Root Mountains to Missoula, Mont.; from Endicott, Wash. Ter., northeasterly, to a connection with the line from Farmington to Spokane Falls, at a point about 12 miles north of Farmington; from a point near the junction of the north and south forks of the Cœur d'Alene River, thence along the north fork and Pritchard Creek to the town of Murray, Idaho, with a branch from a point near the mouth of Beaver Creek up said creek to its source; and from the mouth of Nine Mile Creek, in a northerly direction along said creek to its source.

West Jersey.—The grading of the branch from Sea Isle City, N. J., to Seven Mile Beach, a distance of 5 miles, has been finished by the contractor, A. B. Nelson, of New Brunswick, N. J., and tracklaying is now in progress. There is a pile bridge 1,300 ft. long on the line.

TRAFFIC AND EARNINGS.

The Inter-state Commerce Commision.

NEW YORK MILK RATES.

The Commission on Sept. 24 filed an opinion in respect to rates on milk from points in Orange County (N. Y.) to New York City. The case was heard nearly a year ago. The opinion is by Commissioner Walker; Commissioner Morrison dissents. The complaint is against the New York, Lake Erie & Western, New York, Ontario & Western, Delaware, Lackawanna & Western, and Lehigh & Western roads. The shippers allege that the rates are too high and that it is contrary to law to charge a uniform rate for transportation of milk from all points to Jersey City. Upon the first question, the Commission is unable to reach any satisfactory result, by reason of the absence of proof upon so many important subjects. While there appears to be foundation for the claim, there is no proof of the rates upon the New York roads, which supply the same market, or of many other matters needed to be known before the Commission will undertake to say what would be a reasonable rate. This part of the case is left open for further proof unless the carriers themselves reduce the tariffs.

The subject of grouping the milk rates is exhaustively treated. It is held that while the practice of grouping is not uncommon, each case must be justified upon its own facts. The milk traffic is peculiar, being performed by a solid train run for this especial purpose at a high speed and at extraordinary cost; delays are not admissible; the service is exceptional in many ways, while all this extraordinary expense is for the benefit of the milk business as a whole along the entire route. It does not appear that the Orange County farmers suffer any loss in price, or ability to sell their whole product because other points are served at the same rate, some of which are nearer and some more distant. It is evident that the necessities of the vast body of milk consumers in New York City and Brooklyn require the maintenance of a regular and increasing daily supply, which can only be obtained by going further into the country every year. The practice of charging the same price per can from all points reached by the daily milk trains, in the absence of proof of damage to complainants, is held to be justifiable. Points beyond Port Jervis on the Erie, and beyond Sidney on the Ontario, are reached at considerable special expense and should be differently treated.

The Commission received on Monday of this week the first application for proceedings against the Pacific railroads under the act to require those roads to perform the obligations imposed upon them by law in respect to telegraph service, and to make proper connections with such telegraph companies as may desire it. The application is from the Postal Telegraph Cable Company, which has lines extending from the Atlantic seaboard throughout the northern states, and which connects with the Pacific Coast over the lines of the Canadian Pacific. The company complains that exclusive privileges are given to the Western Union and demands that business offered by itself be accepted and handled on equal terms.

The Commission met at Dover, Del., Sept. 20 to hear the complaints of the Delaware State Grangers against the Pennsylvania road. The Grangers' case consisted of three counts: Excessive and unjust freight charges, bad train service, and discrimination in long and short hauls. The road presented a general denial. Fruit growers allege that from $84 to $90 per carload of 500 baskets was charged for peaches, and that their arrival in Jersey City was seldom within two, three or four hours of schedule time. The Grangers presented as witnesses several dray drivers from Jersey City, who had timed the arrival of every peach train in 1887.

On the second day of the hearing, several officers of the Norfolk Steamship Company testified to an attempt by the railroad officials, since the passage of the Inter-state law, to form a pool for the freight. Mr. Wallbridge, manager of Congressman W. L. Scott's Cape Charles farm, and others, testified to the high freight rates and the indifferent train service.

The Central Traffic Association.

The committee on reorganization held its first meeting at Chicago, Sept. 20. Besides the eight members of the committee, twenty non-association lines, among them the Chicago & Atlantic, Ohio & Mississippi, Wabash Western, Ohio, Indiana & Western, Columbus & Cincinnati Midland, Louisville, Evansville & St. Louis, and others, were present by invitation. The committee presented a statement giving the reasons why the association should be rehabilitated, joined by every eligible line, and perpetuated. The advantage in affording means of arbitration, in abolishing passenger commissions, in procuring actual weights of freight, uniformity of tariffs, etc., are succinctly set forth. Against these are only two reasons for dissolution, the time consumed in attending meetings and the expense. The first can be obviated by calling meetings at rarer intervals, the second by inducing all lines benefited by the association to join the organization and thereby apportion the expense more equitably. Poor's Manual shows that in 1886 the roads in Central Traffic Association territory earned $154,000,000. Of this $113,000,000 was from freight traffic and $41,000,000 from passenger. The lines that are members of the association earned about $100,000,000 of this, $75,000,000 on freight and $25,000,000 on passengers The expenses of the Central Traffic Association Freight De-

partment are $5,100 per month, or $61,200 per year; of the passenger department, $2,500 per month, or $30,000 per year. If all the lines within the territory unite with the organization the cost will be only 54-1.000 of 1 per cent. on freight earnings, or $54 per $100,000 of earnings, and the cost in the passenger department would be only 73-1,000 of 1 per cent., or $73 for every $100,000 of earnings.

Chairman Blanchard told what should be done to increase the effectiveness of the association and at the same time curtail expenses. He suggested penalties for violations of agreement and the deposit of a percentage of the receipts of the various roads, out of which the fines should be taken. He also suggested that a portion of the fine be paid the person who secures the conviction; thought it necessary that the territory of the association be enlarged; that the roads running east from Milwaukee be taken in, and also that some of the roads south of the Ohio River and the lines between Buffalo and Rochester that are not members of the Trunk Line Association be admitted. He stated that he had perfected arrangements by which the expenses of the association would be reduced Oct. 1 about $12,000.

The representatives of the outside lines expressed their belief in the necessity of such an organization, and most of them signified a willingness to become members if the conditions of the contract could be made satisfactory. Chairman Blanchard was requested to send to the roads in the territory of the association a copy of his recommendations. The paper containing these recommendations is summarized in a press dispatch as follows:

"The problems which an association of this kind should seek to solve are: First—How can roads of dissimilar facilities secure their proper shares of freight and passenger traffic at similar rates? Second—If they cannot secure them at similar rates shall there be differential rates, what shall they be and how shall they be determined? Third—Shall individual judgment be justly subordinated to the general good in deciding such questions, and under what regulations and compensations? Fourth—How shall a quick tribunal of decision be provided when managers differ?

By way of answer to these questions, Mr. Blanchard suggests that a board of three should sit permanently, to be called the "Executive Board," to consist of the chairman and two others; that this board from time to time decide what proportion of each class of traffic each competing line is entitled to, with discretion to change this view as often as the circumstances warrant their judgments in changes. The board should have the right for such periods as it may see fit, by procedure conformable to law, to advance or reduce rates or fares via the different routes and upon different commodities and travel so as to produce the equalization its judgment approves As a method of arriving at the settlement of all disputes, the contract should be so amended as to provide in detail for the unconditional reference of such disputes to the Executive Board within a specified period, the decision of the board to be final and subject to no appeal but to itself. The board should be authorized to decide every question at issue. It should have the right to decide if any line is entitled to compensation when bad faith or improper procedure has deprived it of traffic, and then to assess the amount to be paid and the roads to pay, having the power to assess a fund large enough to render the loss undesirable and from which to pay fines, penalties or forfeitures. Each company should file with the Executive Board the name of one officer, and one only, who will be responsible to the Board and to the association for the making of all its rates and fares. Where one officer has charge of the through business and another of the local business a complete register of these officers should be filed, if one cannot be designated, who shall be held by the Board and by their own companies responsible in each and every instance, without evasion or demur, for every lapse or violation that occurs involving rates or fares.

Mr. Blanchard further proposed that the managers at every important point in the territory form themselves into committees which shall be charged with the conduct of affairs at such points and make each member responsible for his road therefrom. These managers' committees might file with the Executive Board the names of two of their number who could act with it as an increased board of five in the event that any party to an issue raised at such a point should call for the addition of local representation. There should be no exemptions by which a certain part of the business of the association is relegated to independent committees. The entire traffic is too closely interlinked to avoid injury to it all if one portion becomes demoralized; if the association is qualified to deal with a part it should be with all.

The Central Traffic Association has established freight inspection and weighing bureaus at the following points: Chicago, St. Louis, Cincinnati, Indianapolis, Columbus, Toledo, Cleveland, Dayton, Mansfield, Springfield, O., Akron, Detroit, Grand Rapids, Muskegon, Louisville, Jeffersonville and New Albany. Superintendent Richardson is at work establishing additional bureaus at other points.

Passenger Rate Cutting.

Competition between the Cleveland, Columbus, Cincinnati & Indianapolis and the Vandalia line on passenger rates eastward from St. Louis, which began a week ago, has spread so as to affect the through passenger traffic over all the lines between Cleveland, Cincinnati and St. Louis. The trouble began by the selling of cheap round-trip excursion tickets, and rates to and from Cincinnati, Columbus, Cleveland and Pittsburgh were reduced, one after another. Round trip tickets were sold last week at St. Louis for New York at $23; Columbus, O., $7; Cleveland, $8.65; Pittsburgh, $9.65. On Wednesday of this week the Bee Line announced a single-trip rate to New York of $14.50; the Ohio & Mississippi, $15.50 single trip, and $21 round trip. The Vandalia made a round trip rate between Cincinnati and St. Louis of $5; Columbus and St. Louis, $7; Cleveland and St. Louis, $9.

Trunk Line Rate

Rates on dressed beef and live stock, as well as upon grain, remain unsettled. The Pennsylvania and Vanderbilt lines are charging 35 cents on dressed beef, Chicago to New York, but the Chicago & Atlantic continues to take this freight at 30½ cents. Both the Pennsylvania and Vanderbilt lines take dressed beef to Boston at 35 cents, the same as the New York rate, in order to meet the competition of the Grand Trunk.

The meeting of the presidents of the trunk lines in New York last week is reported to have taken no action, except to request the New England roads to stop cutting west-bound lake and rail rates.

The Sault Ste. Marie all-rail lines have reduced grain rates from Minneapolis and St. Paul to New York to 27½ cents, and the Lake Superior lines to 22½, to meet the reduction of the trunk lines via Chicago.

Grain Rates.

A Chicago dispatch of Wednesday says: A vote by telegraph to-day showed that all the lines in the Central Traffic Association are now unanimously in favor of restoring rates to the tariff of March 5, on fourth, fifth and sixth classes [which restores grain from 20 cents, the rate made by the Pennsylvania a fortnight ago, to 25]. The right to drop to the present figure is reserved by the Pennsylvania Co., if the higher rate is broken by any other line. The restoration will take effect Oct. 8. A vote will now be taken on the proposition to restore rates on the higher classes of freight.

Western Freight Association.

The new agreement provides for the appointment of executive committees for the various divisions. The committees are constituted as follows: Northwestern Division—Chicago, Milwaukee & St. Paul, Wabash Western (?) and Chicago, St. Paul & Kansas City; Western Division—Chicago & Northwestern, Chicago, Burlington & Quincy and Chicago, Rock Island & Pacific; Southwestern Division—Chicago & Alton, Chicago, Santa Fe & California and Missouri Pacific. These members of the executive committees are constituted a joint executive committee to act on all matters of common interest to the associated roads. In accordance with one of the sections of the agreement an officer (the traffic manager or general freight agent) has been designated to be held personally responsible for the rates on each.

Iowa Rates.

The Railroad Commissioners of Iowa have decided, in the case of J. H. Morrill & Co., of Ottumwa, against the Keokuk & Western, that the violation of the long and short haul clause of the state law by the road for the purrose of competing with another railroad having a shorter line is wholly unjustifiable. The intent of the law, say the Commissioners, seems to be to give competitive business to the shortest line in every case.

East-bound Shipments.

The shipments of east-bound freight from Chicago for the week ending Sept. 15 amounted to 48,001 tons, against 47,646 tons during the preceding week, an increase of 355 tons, and against 50,285 tons during the corresponding week of 1887, a decrease of 2,284 tons. For the week ending Sept. 22 the shipments amounted to 48,927 tons, an increase of 1,926 tons over the preceding week, and an increase of 4,396 tons over the corresponding week of 1887. This includes flour, grain, seeds, provisions, dressed beef, hides, wool and lumber. The following table gives the details:

	Sept. 22. P. c.	Sept. 15. P. c.
Wabash	8.6	8.7
Michigan Central	8.3	7.3
Lake Shore & M. S	15.6	16.7
Pitts., Ft. Wayne & Chic	16.1	14.4
Chicago, St. L. & P	8.9	14 5
Baltimore & Ohio	7.3	8.9
Chicago & Grand Trunk	14.5	10.4
N. Y., C. & St. L	7.8	8.5
Chicago & Atlantic	13 0	10.6
Totals	100.0	100.0

Cotton.

The cotton movement for the week ending Sept. 21 is reported as follows, in bales:

	1888.	1887.	Decrease.	P. c.
Interior markets:				
Receipts	58,837	116,697	57,860	49.5
Shipments	43,620	86,655	43,035	49.6
Stock	36,508	82,554	46,046	55.7
Seaports:				
Receipts	89.677	187,740	98,063	52.3
Exports	51.779	58,718	6,939	11.8
Stock	198,747	299,139	100,392	34.2

Coal.

The coal tonnages for the week ending Sept. 22 are reported as follows:

	1888.	1887.	Increase.	P. c
Anthracite	869,136	612,446	256,690	41.9
Bituminous	310,441	291,069	19,372	6.7

The coal and coke tonnage of the Pennsylvania originating on lines east of Pittsburgh and Erie for the week ending Sept. 15, and the year to that date, was as follows:

	Coal.	Coke.	Total.
Total for week ending Sept. 15..	227,679	86,784	314.463
Total for year 1888 to date	8,204.495	2,742,300	10.946.795
Total for year 1887 to date	7,273,293	2,427,089	9,700,382

The anthracite coal tonnage of the Belvidere division of the United Railroads of New Jersey division for the same periods was as follows:

	1888.	1887.	Inc. or Dec.
Total for week ending Sept. 15..	41,201	29,493	I. 11,707
Total for year	1,134,274	1,143,375	D. 9,100

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

	1888.	1887.	Inc. or Dec.	P. c.
Month of August:				
Leh. & Wilkesb.C.	$1,068.940	$849,003 I.	$219,937	25.9
Net	265,484	142,559 I.	122,925	86.2
Nash., C. & St. L.	272,185	272,481 D.	296	0.1
Net	116,681	125,890 D.	9,809	7.7
Rich.& W. P Ter.				
Rich. & Danv.	395,148	358,659 I.	36.489	10.2
Net	174,183	156.922 I.	17,261	11.0
Va. Mid. Div.	171,810	151,894 I.	19,916	13.1
Net	71,692	65.794 I.	5,898	9 0
Char., C. & A.	71,495	60.703 I.	10,792	17.8
Net	19,346	16,197 I.	3,149	19 4
Col. & Gr. Div.	49,061	37,854 I.	11,207	29.7
Net	17,662	1,805 I.	15.857	
W.N.Car. Div.	56,657	63,795 D.	7,138	11.2
Net	8,548	7,146 I.	1,402	19.7
Total (gross)	744,172	672,906 I.	71,265	10 6
Total (net)	291,432	247,866 I.	43 566	17.6
Summit Branch	145,577	119,943 I.	25,634	21.4
Net	24,922	8.566 I.	16 356	192.4
Lykens Valley.	91,692	65,181 I.	26,511	40.6
Net	5,284	def. 14,744 I.	20 028	
Staten Isl. R. T.	131.921	120,462 I.	11,459	9.5
Net	60,882	53,782 I.	7,100	13.2
Total (gross)	$1,341,125	$1,121,484 I.	354,510	3.2
Total (net)	764,085	563,919 I.	200,166	37.3
Month of July:				
C., I., St. L. & C.	196,731	214,384 D.	17,653	8.2
Net	67,020	86,067 D.	19,047	22.1
Den. & R. G.	671,977	678,170 D.	6,193	0.9
Net	241,990	299,670 D.	57,680	19.3
Gr. Trunk of C.	1,564,507	1,696,215 D.	131,708	7.8
Net	437,862	542,966 D.	105,104	19 3
Chic. & Gr. T.	241,333	276,460 D.	35,127	12.7
Net	39,423	72,119 D.	32,696	33.4
D., G. H. & Mil.	95,934	97,853 D.	1,919	2.0
Net	26,933	25,090 I.	843	3.3
Louis., N. A. & C.	202,451	204,921 D.	2,490	1.2
Net	87,599	77,239 I.	10,360	13.4
Ore Imp. Co.	421,037	376,393 I.	44,644	11 9
Net	105.549	117.462 D.	11,913	10.1
Scioto Valley	52,789	69,335 D.	16,546	23.9
Net	5,194	19,224 D.	14,030	73.1
So. Pac. (Pac. S.)	2,947,469			
Net	1,089,613			
Wabash	511,999	638,573 D.	126,574	19.8
Net	73,292	256,686 D.	182.394	71.1
Wisconsin Cent.	327,606	352,049 D.	24,443	6.9
Net	97.009			
Total (gross)	$3,958,738	$4,252,304 D.	$293,566	6 9
Total (net)	1,084,862	1,496,523 D.	411,661	27.5
Eight months—Jan. 1 to Aug. 31:				
L. & W. & St. L.	6,547.151	5,444,757 I.	1,102,394	20.2
Net	1,257,023	712,692 I.	544,331	76.4
Nash., C. & St. L.	2,024,784	1,985 638 I.	39,146	2.0
Net	830,630	895,752 D.	65,122	7.3
Rich. & W.P.Ter.				
Rich. & Danv.	2,828.540	2,596 727 I.	231,813	8.9
Net	1,210,485	1,134,506 I.	75,979	6.7
Virginia Midl.D.	1,184,893	1,055,552 I.	129,341	12.3
Net	497,569	417,642 I.	79,927	18.9
Char., Col.& A.	563,924	494,747 I.	69,177	13.9
Net	204,701	169,882 I.	34,819	20 5
Col. & Gr. Div.	377,828	312,389 I.	65,439	20.9
Net	129,345	31 850 I.	97,495	305 6
W. N. Car. Div.	408,273	448,846 D.	40,573	9.0
Net	64,423	61,152 I.	3,271	5.4
Total (gross)	5,363,458	4,908,261 I.	455,197	9.4
Total (net)	2,106,523	1,815,032 I.	291,491	16.1
Summit branch	957,910	790,184 I.	167,726	21.2
Net	195 230	4 153 I.	131,077	
Lykens Valley.	674,282	417.521 I.	256,761	61.6
Net	def. 22,064	def. 146,028 I.	123,964	
St. I Rap. Tran.	646,117	598.478 I.	47,639	8.0
Net	204,246	160,299 I.	43.947	27.4
Total (gross)	$16,213,702	$14,144,839 I.	$2,068 863	14.6
Total (net)	4,511,588	3,441,900 I.	1,069,688	31.7
Seven months—Jan. 1 to July 31:				
C., In., St. L. & C.	1,458.695	1,500,111 D.	41,416	2.8
Net	543,248	574.279 D.	31,031	5.4
Den. & R. G.	4.226,691	4,233.706 D.	7.015	0.2
Net	1,280,210	1,697,975 D.	417,765	24.6
Grand Trk. of Can.	9,843.507	10,607,571 D.	764,064	7.2
Net	2,756.008	3,272,879 D.	516,871	15.8
L., N. A. & Chic.	1,220,443	1,237,223 D.	16 780	1.4
Net	391,295	315,870 I.	75,425	23.9
Ore. Imp. Co.	2,911.618	2,180,795 I.	730,823	33 5
Net	617,545	546 985 I.	70.560	12.9
Scioto Valley	364,974	423,346 D.	58,372	13.7
Net	56,184	87,054 D.	30,870	35.4
So. Pac.(Pac.Sys.)	19.549,542			
Net	6,881.635			
Wabash	3,423,965	3,721,410 D.	297.445	8.0
Net	505,380	1,234,495 D.	729,115	59.1
Wisconsin Cent.	2,011,908	1,997,340 I.	14,568	0.7
Total (gross)	23,449.893	$23,904.162 D.	$454.269	1.9
Total (net)	6,149,870	7,529,537 D.	1.379,667	20 3

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

The annual report of the Chicago, Kansas & Nebraska road (Rock Island system) has been submitted to the Kansas Railroad Commissioners. It makes the following showing: Amount of stock issued this year, $3,557,200; amount of bonds issued this year for construction, $13,000,000; bonds sent to Chicago, Rock Island & Pacific Co. and not yet accounted for, $20,000,000; total amount of paid-up stock and debt, $26,086,599.81; amount of stock and debt per mile of road, $22,107.29; cost of right of way, entire line, $2,873,901.54; cost of construction, entire line, $19,168,372.38; cost of present equipment $2,801,817.18; total cost of construction and equipment to June 30, 1888, $24,849,092.10; total operating expenses of the line for the year, $1,472,570.

The comparative statement of earnings and expenses of the San Antonio & Aransas Pass for the year ending June 30 shows:

	1888.	1887.	Increase.
Gross earnings	$834,709	$291,768	$542 941
Oper. expenses, interest	767,023	244,005	523,018
Net earnings	$67,686	$47,763	$19,923

The report of the Chicago, St. Paul, Minneapolis & Omaha for the year ending June 30 shows the following comparison with last year:

Year to June 30:	1887-8.	1886-7.	Inc. or Dec.
Earnings	$6,740 241	$6,396,110 D.	$344,131
Expenses and taxes	4,804,679	4,046.329 I.	758,350
Net	$1,935,562	$2,349,781 D.	$414,219
Other income	621,625	*697,783 D.	76,158
Total net	$2,557,187	$3.047.564 D.	$490,377
Interest and rentals	1.376,962	*1,385,459 D.	8,497
Balance	$1.180,225	$1.682,105 D.	$518,120
Dividends	675,408	*708,236 D.	32,828
Surplus	$504,817	$953.869 D.	$449,052

*One-half of average of two years.

The earnings and expenses of the same road for the first half of the calendar year were:

Six months to June 30:	1888.	1887.	Inc. or Dec.
Earnings	$2 792,370	$2.993.001 D.	$206 621
Expenses and taxes	2,249,694	2,078,629 I.	171,065
Net	$542,676	$914,372 D.	$371,696

The statement of the Cleveland & Canton for the month of August shows:

	1888.	1887.	Inc. or Dec.
Gross earnings	$34.382	$33.096 I.	$1.286
Oper. expenses	22,849	20,581 I.	2,268
Net earnings	$11,533	$12,515 D.	$982

The statement of the Baltimore & Ohio for the month of August, and the eleven months ending Aug. 31, is as below:

Month of August:	1888.	1887.	Inc. or Dec.
Gross earnings	$1,958 548	$2,031.681 D.	$73,133
Oper. expenses	1,188,284	1,176,255 I.	12,029
Net earnings	$770,263	$855,426 D.	$85.162
Eleven months to Aug. 31:			
Gross earnings	$18,567,534	$18,604,350 D.	$35,816
Oper. expenses	13,252,645	12,967 238 I.	285.407
Net earnings	$5,314,889	$5.637,112 D.	$322,223

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